SPORTSMANLIKE DRIVING

AMERICAN AUTOMOBILE ASSOCIATION
WASHINGTON, D. C.

FOREWORD

AS WE start out together on what may be termed the Atomic Age, we may occasionally forget that however terrible it may be or however interesting a challenge it may become, we shall not live to see what happens if we do not understand sportsmanlike driving. I trust the day may soon pass when parents think they are competent to instruct their sons or daughters in the art of automobile driving. Parents do not make the best teachers. Sometimes they do not drive very well themselves and unfortunately do not know that this is true. In fact, many adults today are alive because of the kind consideration of good drivers. In addition, parents fail because of impatience and because of a host of problems, in general the same problems which make it wiser for parents to send their children to school instead of trying to teach them at home.

Young persons, of course, want to live to enjoy competitive sports where some risks must be taken and to have their full share of adventure in hunting and fishing and outdoor sports. But we must learn to avoid the silly risks which persons sometimes take if we are to be fit for the adventure, competitive sports, and thrilling red-blooded living which appeal to all Americans.

In the recent World War, 1,070,000 American youths were wounded, killed, missing in action or taken prisoner. During the same period, 3,300,000 civilians lost their lives or were injured in traffic accidents, right here on the home front. It is heroic and patriotic to lose one's life *for* some great goal and ideal such as defending our country and seeking liberty for all persons. On the other hand, there is nothing heroic or wonderful about losing one's life through poor driving or through taking unnecessary and foolish risks. Chance-taking and unsound driving practices also frequently involve injury or death to others than the driver.

As one who has been interested in safety education for many years, it is a pleasure to welcome this new edition of SPORTSMANLIKE DRIVING, one brought up to date for the new decade

ahead. It is my sincere hope that every high school throughout America will within the next five years undertake regular and systematic courses in driver education and training—a necessity of our modern industrial age. Only in such a manner can we rear a new generation of competent drivers.

HENRY H. HILL.

Editor's Note—A leading educator who has had wide experience in all phases of public safety education in the United States, Dr. Henry H. Hill kindly consented to prepare the foregoing foreword because of his enthusiastic interest in helping high school youth attain driving skill and competence.

Dr. Hill is President of the George Peabody College for Teachers, Nashville, Tennessee, one of the leading teacher preparation institutions in the country. He was President (1946-47) of the American Association of School Administrators of the National Education Association, and was formerly Superintendent of Schools at Lexington, Kentucky and Pittsburgh, Pennsylvania.

Dr. Hill's keen interest in traffic safety education is a long standing one. When the National Education Association decided in 1937 to explore how best to improve school programs of safety education throughout the United States, they appropriately selected Dr. Hill as Chairman of a "Commission on Safety Education." This Commission produced the 1940 AASA Yearbook, "Safety Education." It crystalized many ideas which have resulted in improved school traffic safety programs, including high school driver education and training courses for which SPORTSMANLIKE DRIVING is intended.

INTRODUCTION

NEARLY half of all persons over sixteen years old in the United States are drivers of motor vehicles today, and the number is growing rapidly. The much-too-high annual totals of traffic accidents and violations are proof that all too many fail at times to be skilful, competent, sportsmanlike drivers.

Yet a great many drivers use and enjoy their cars year after year without accident or other traffic trouble. They demonstrate that high quality, accident-free driving is attainable. Most drivers can achieve clear records if they want to strongly enough, and if they exercise self-control, correct or compensate for physical and emotional deficiencies, attain the necessary know-how, develop high quality driving skill, have proper attitudes and fully accept their responsibilities in traffic.

The best way to become expert is to develop the above characteristics from the very start, as beginning drivers or learners, *under the guidance of a competent instructor.* Fortunately, high schools are providing carefully planned courses in driver education and training in rapidly increasing numbers. Hence, it seems reasonable to hope that, in the not distant future, all of the million and a half young people graduating from high school annually will have proper education and training for living in this Motor Age—both as drivers and pedestrians.

This textbook is dedicated primarily to those beginning drivers. But it will also aid hundreds of thousands who realize that they need to improve their driving and walking practices—and have the good sense to *determine* to do so. Many motor vehicle fleets, branches of the armed service, Red Cross Motor Corps, school-bus groups, police, adult driver-training groups and others have used the text in the past and will find this streamlined edition even more effective.

In the sense that SPORTSMANLIKE DRIVING is reorganized, almost completely rewritten, and greatly improved, it is a new text. But it is the outgrowth of more than a decade of experience in both class work and behind-the-wheel training, and of many editions of SPORTSMANLIKE DRIVING text pamphlets of which more than a million copies have been dis-

tributed. So, in this sense, it is a time-tested, veteran text. The writing and extensive illustration are the work of experienced specialists. All material then was checked by other specialists in the respective fields dealt with, and by experienced educators.

This new text is presented in four parts, as follows:

Part I. The Driver and the Pedestrian
Part II. Sound Driving Practices
Part III. How to Drive
Part IV. The Motor Age Advances

Part I deals with the individual, both as a driver and as a pedestrian. It provides an understanding of what the job of a driver is and of the importance of building sound driving habits. It shows how the "human element" affects driving, and how one may correct or compensate for deficiencies. It also treats of the rights and responsibilities of pedestrians.

Part II shows that knowledge of traffic laws is one essential basis for the development of sound, courteous, law-observing driving. But it emphasizes that knowledge of laws is not enough. Laws are subject to change and, despite much progress, are not uniform among all states. Hence, to avoid trouble, the best guide is a thorough knowledge and constant use of universally effective *sound driving practices.*

Part III includes a step-by-step procedure for driving a car. It presents the essential facts about what makes the car run—what the various gauges and devices are and what they indicate or do, how the engine produces power, how that power is controlled and caused to do different kinds of work, and how to take proper care of the car. It emphasizes that steps in learning to drive must be in proper order, and that each succeeding step must be based on what has already been learned. The text helps the learner apply the basic principle of *doing each step correctly from the first.*

Part IV indicates the extensiveness of the changes produced in our lives by the motor vehicle, the social problems which have been created, and the methods which are being used to reduce traffic casualties and to make use of cars and highways more efficient and pleasant. It includes the story of the motor car, the development of highways, and the management of highway

and street use through the application of traffic engineering and enforcement techniques. It demonstrates the importance of a traffic-informed citizenry.

Users of this textbook will want to understand and apply every part of it. Most applications will be personal, but some will involve the community and state. Much benefit will come from discussing the points of the text with others, and for this purpose the Discussion Topics at the end of each chapter are recommended. Users should *learn by doing* as many of the things presented in the text and Projects as practicable.

Mrs. Helen Champlin Knandel, formerly of The Pennsylvania State College, was mainly responsible for the organization of this revised text. She was invited to prepare it because of her editorial ability, demonstrated in much past work on earlier text editions, and because of a background of training and experience in Educational Psychology.

Special credit is due Prof. Amos E. Neyhart, Administrative Head, Institute of Public Safety, The Pennsylvania State College and Consultant on Road Training, American Automobile Association, for his leadership in this field and for his many contributions, particularly to Part III, "How to Drive." This section is largely an outgrowth of the sound step-by-step method developed by Prof. Neyhart.

The influence of the other original writers is also still strong in the text. So, in addition to Mrs. Knandel and Prof. Neyhart, credit is properly given to William J. Cox, then of Yale University, Dr. Maurice R. Davie of Yale University, and Peter J. Stupka, then with the American Automobile Association.

Acknowledgment of highly valued assistance is also given to Donald Blanchard, Secretary, Technical Board, Society of Automotive Engineers; W. Roy Breg, Executive Secretary, Allied Youth, Inc.; Harold O. Carlton, Educational Consultant, American Automobile Association; Roy W. Crum, Director, Highway Research Board; R. J. Devereaux, The B. F. Goodrich Company; Dr. H. C. Dickinson (retired), The National Bureau of Standards; Dr. Robert W. Eaves, Secretary, National Commission on Safety Education, National Education Association; John W. Gibbons, Director, Public Relations, Automotive Safety Foundation; William M. Greene, Director,

Connecticut Highway Safety Commission; Hal H. Hale, Executive Secretary, American Association of State Highway Officials; Harold F. Hammond, then President, Institute of Traffic Engineers; John E. Kane, American Petroleum Industries Committee; G. Donald Kennedy, Vice President, Automotive Safety Foundation; Norman Key, Educational Consultant, American Automobile Association; A. W. Koehler, Secretary-Manager, National Association of Motor Bus Operators; Col. Franklin M. Kreml, Director, Northwestern University Traffic Institute; Dr. A. R. Lauer, Professor of Psychology and Highway Safety, Iowa State College; J. Willard Lord, Safety Engineer, Atlantic Refining Company; D. Grant Mickle, Traffic Engineer, Automotive Safety Foundation; Ralph A. Moyer, Professor of Highway Engineering, Iowa State College; H. G. Odgers, Director of Safety Education, Dearborn (Michigan) Public Schools; J. T. Reesing, Instructor in English, George Washington University; R. E. Royall, Chief, Division of Research Reports and Statistics, U. S. Public Roads Administration; Dr. Edwin H. Silver, Chairman, Motor Vision Commission, American Optometric Association; C. W. Stark, Assistant Manager, Transportation and Communication Dept., Chamber of Commerce of the United States; George R. Wellington, Chief, Section of Safety, Interstate Commerce Commission; Sidney J. Williams, Assistant to the President, National Safety Council.

Literally hundreds of practicing teachers, professors in teacher training institutions, and school administrators have also made valuable practical suggestions.

Work on this text and the broad driver education and training program of the Association have been greatly aided by grants from the Automotive Safety Foundation.

My associate, W. L. Robinson, had over-all responsibility for guiding the editing and preparations for printing. Other associates, especially LeVerne Johnson and Earl Allgaier, did valuable work. The illustrations are the work of Mrs. Iris B. Johnson and Edward C. Michener. The latter prepared the unique front and back cover designs.

BURTON W. MARSH, *Director*,
Traffic Engineering & Safety Department,
American Automobile Association

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PART I • The Driver and the Pedestrian

CHAPTER I

The Automobile and Its Driver

Do You Know:

What power means to man?
How the automobile has changed our lives?
Where we have failed in using it?
What we can do to correct the failure?

A POWER AGE

WE LIVE in a Power Age.

We still find ourselves speaking of power in terms of the horse. For not so long ago the power of a horse to do man's work was top-ranking power, and we accepted it as an easy unit of power measurement.

Associated Press Photo

FIG. 1. Whether power comes from atomic fission or gasoline combustion, man must be in control.

But the power of a single horse now seems puny indeed. For, in our day, man has learned to produce and harness power almost beyond his own measurement and comprehension.

The forces that give us a Power Age unequalled in history challenge man's control. For the mechanical contraptions of man, whether developed through combustion, electricity, or atomic energy, carry out man's will, never any will of their own. The machines themselves cannot learn from experience or act with conscience. They produce results that are destructive or wholesome depending on the understanding and conscience of the men in control. No machine is good or bad. Man behind the machine is wholly responsible for whatever the machine is made to do.

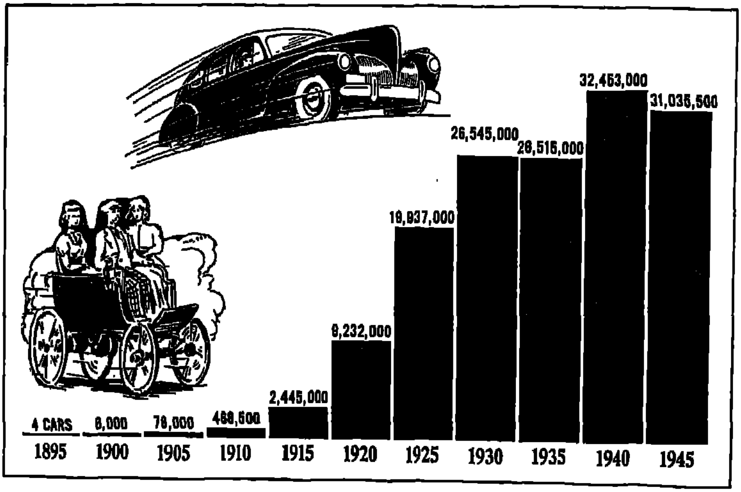


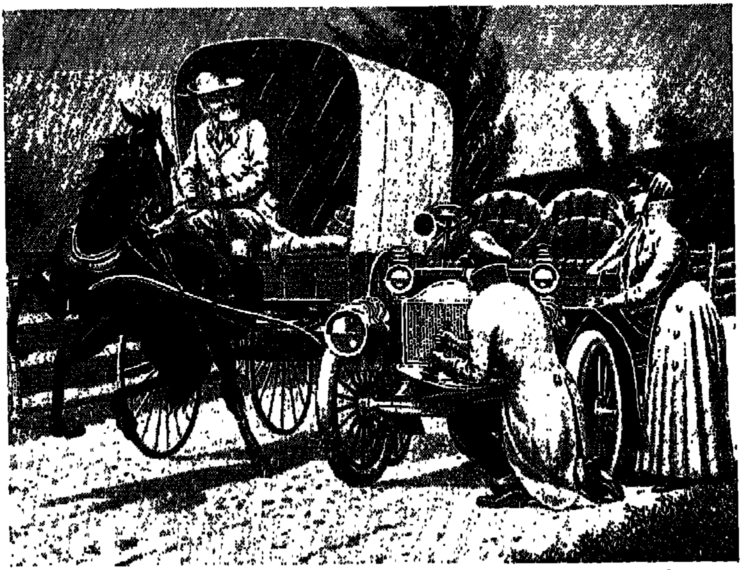
FIG. 2. Rapid growth of motor vehicle registration in the United States.

The critical question of our age is not how to produce more power but whether or not man's purposes in life are worthy of the power he can now summon to make his wishes and purposes come true. Wherever man uses the power machines he has devised, he must learn to accept the moral responsibility of using them.

THE AUTOMOBILE

For transportation, the automobile is man's most popular power machine. But it is becoming more and more evident that its service and satisfaction depend on how ably and fairly he uses it.

The American public has accepted the automobile with open arms. Families either have cars or want to acquire them as soon as possible. Because of the automobile, greater changes have occurred in transportation in the last three decades than had occurred in the entire previous history of the world. For business and pleasure, we consider it a necessary part of our daily life. Our streets and highways are becoming increasingly crowded with cars of every description. In half a century of use, the car has become such an important and common tool in our civilization that training in skilful and sportsmanlike driving is now a critical part of the education society owes its youth.



Courtesy Edison Institute, Dearborn, Michigan.

FIG. 8. "Get a horse!"

How the Automobile Has Changed Our Lives

The half century of the automobile has changed our civilization almost beyond recognition.

"Get a horse" people shouted only a generation ago, amused when the early "horseless carriages" broke down.

But the motorist has had the last laugh. For within a generation the old carriage society has been transformed into an automotive civilization. The American family has come to think of the automobile as almost a necessity. American business has thrived on it. The automobile is used more and more for commerce, convenience, and pleasure. We are a people who like to be on wheels.

For civilian use, the automobile was considerably chain-bound during World War II. The supply of cars was cut off, fuel was rationed, travel restricted, and a halt was put to what would have been a normal growth in the use of the automobile. At the close of the war, there was a rapid increase in traffic

FIG. 4. Almost as soon as it's decided, the family has motored to a picnic spot.

volume. As fast as reconversion and new production made it possible, people had new cars, trucks, and buses.

Before the war about fifty-two million persons took to the roads annually as tourists. More than fifteen million of these people visited the national park areas. There were over 300,000 house trailers.

The automobile is a wonderful asset to civilization but it creates new and perplexing problems. In one generation it has made a good many changes in our manners and morals.

For Family Activities

American families have learned to depend on the automobile. Dad's fishing trip, the family's summer vacation, an after-dinner ride, the Sunday picnic, and week-end motor trips are accepted features of modern American life. Thousands of parents daily drive their children to school. Large numbers of older students drive themselves.

The car has multiplied many times the leisure-time activities of wage earners. A picnic, a swim, or a game of golf can be a matter of a moment's decision on a hot afternoon. Many families spend their holidays on motor trips. Touring for a week-end or a season has become widespread. Family disputes arise over who shall have the car Saturday night. The automobile has completely changed family activities and social customs.

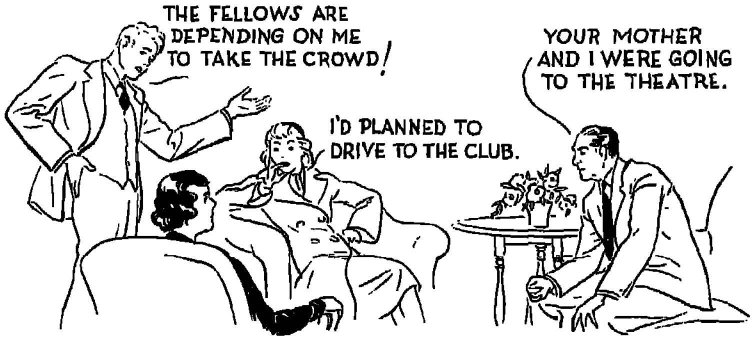


Fig. 5. Who's going to use the car?

The Automobile and the City-Dweller

Although the automobile has added greatly to the pleasure of life, it has also brought annoyances, inconveniences, and hazards.

In cities, traffic has become so congested and hazardous as to command national attention. Automobiles increase at a rate

limited only by production and the American pocketbook. Streets increase in mileage and capacity much less rapidly. Most of our town and city streets were designed for the horse-car and the horse-and-buggy. With modern buses, streetcars, and a flood of automobiles, too many streets are made to serve new purposes as best they can. New and pressing traffic problems naturally result.

Quiet residential streets are sometimes transformed into noisy, dangerous, fume-filled, bustling traffic arteries which people try to avoid for their residences.

Because of the automobile, people can now live at a considerable distance from their places of employment. Suburban residential areas are built many miles away from the central city.

The abandonment of inner sections of the city as select residential areas lowers land values and therefore the city income derived from taxes.

In addition to the increasing volume of moving traffic, parked cars and the loading and unloading of commercial vehicles reduce space for traffic flow. The demand for parking space on city streets exceeds the supply, especially where there is considerable long-time parking.

The automobile has also intensified the need for playgrounds and neighborhood parks, since playing on streets and highways is no longer safe.

How can we modify the use of city streets for the motor age? How can residential areas be protected? How can traffic be routed and controlled? These are problems that must be faced.

If You Live in the Country

Highways and automobiles have brought town and country closer together. Many farmers and their families drive to several towns in a half day's shopping tour.

A larger and more modern rural community is emerging, with the village or town as its center. Stores, theatres, libraries, and other institutions are expanding in these centers. Churches in the open country are closing; village churches are increasing in membership and in activities.

The "little red schoolhouses" are giving way to centrally located consolidated schools which serve larger areas and provide better teachers and facilities. This educational improvement was made possible by good roads and motor transportation, especially by the school bus. Children can now go to school from long distances and in almost any weather.

Good roads and motor transportation have also brought improved mail and parcel post service to rural areas.

The isolation of the farmer and country folks is a thing of the past.

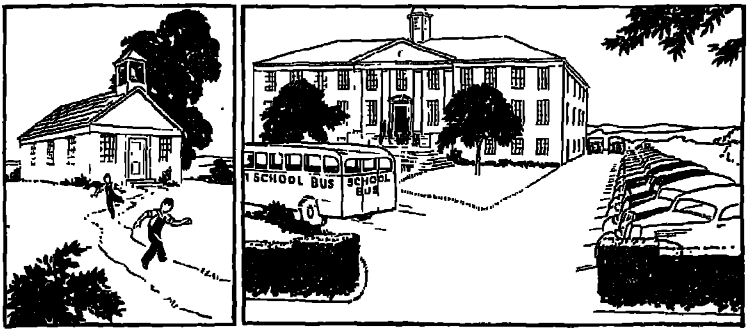


FIG. 6. Fine consolidated schools made possible by motor transportation are eliminating the "little red schoolhouse."

Travel by Bus

With the coming of the motor bus, thousands of communities gained an intercity and interstate travel service not previously provided. Today, a national network of interconnecting bus routes makes it possible to travel comfortably, conveniently, and economically by bus to almost any point in the United States.

Passengers carried on buses operated by intercity carriers in 1944 numbered 1,162,000,000. As of December 31, 1944, there were about 161,107 motor buses in operation in common carrier, charter hire, and school bus service. About 77,000 were school buses.

The motor bus competes with the railroad in some ways, but it also supplements and "feeds" the railroads. The railroads

themselves are operating an increasing number of buses, especially for short hauls and as feeder service for the main lines. Flexibility of routing assures the bus a permanent place in the transportation picture.

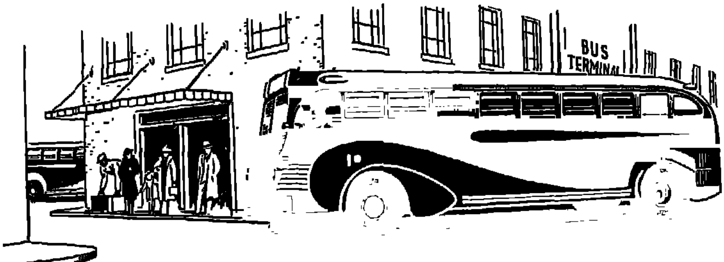


FIG. 7. What a development there has been in bus transportation!

Since 1924 there has been a steady growth in the number of buses operated by electric railway companies. In a number of cities, street cars have been entirely replaced by buses. In other areas, particularly industrial areas with heavy passenger loads, the street car continues to be an indispensable means of mass transportation. A new balance is being established between the street car and the bus, each succeeding where it serves best.

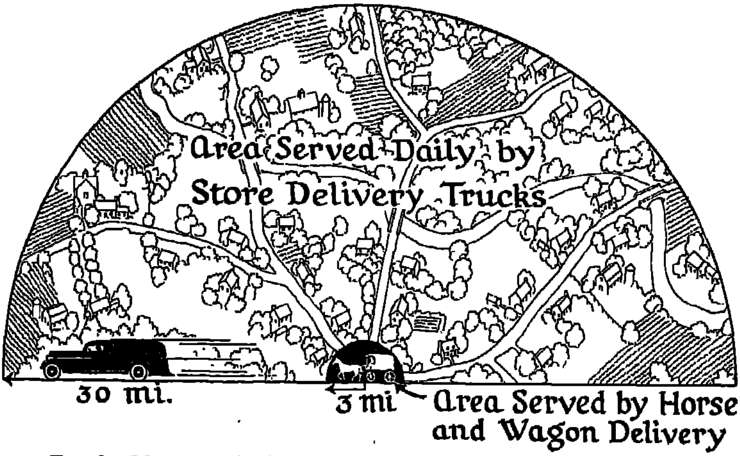


FIG. 8. Motor trucks have greatly enlarged store delivery areas.

The Motor Truck

As the car extends the social community, so the motor truck extends the size of the economic region.

The truck has rapidly come to the front as a conveyor of both "short-haul" and "long-haul" freight. It can follow any desired route or change its schedule to provide quick, effective service over both short and long distances.

FIG. 9. One unit of a new type of freight car is hoisted onto a truck for store-door delivery.

Large stores deliver their merchandise by truck over a wide shopping radius. Daily, free delivery service has greatly increased trade.

The motor truck also speeds up the marketing of agricultural products. Food on the American table today is fresher and more varied than in the days of the four-miles-an-hour horse-and-wagon transportation. The truck has brought orchards, farms, and dairies "close" to city residents. Farmers make daily truck deliveries to farm markets and creameries.

The railroads are using trucks increasingly for "door-to-door" freight handling. Trucks enable the railroads to furnish service which the shipper or receiver provided previously by hiring a horse-drawn dray.

The Automobile and Employment

The automobile is responsible for the employment of very large numbers of people. In a very short period it has created a vast industry of its own.

More than four million cars and trucks were sold in the United States and Canada in 1941. Then in February, 1942, the war stopped all civilian production. With production again in full swing now, the annual volume of motor sales will no doubt soon top anything we have seen in the past. This will mean steady employment for vast number of workers. In 1945, 31,035,500 automobiles were registered in the United States. One out of every seven persons gainfully employed derives his income directly or indirectly from the automobile industry.

Not only has the manufacture, distribution, and sale of the automobile become a major industry, but the automobile has aided in the development of many related industries which have attained enormous proportions.

The gasoline station is one evidence of such development. The tire store is another. Many of the roads in the United States have been paved or improved because of the demands of automobile traffic. The purchase of automobiles on the installment plan has greatly accelerated the use of credit facilities.

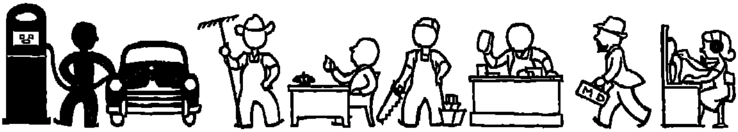


FIG. 10. Every seventh person owes his job to the automobile.

In normal years about five billion dollars are spent by automobile tourists. Many people earn money caring for the wants of these travelers. The "tourist business" has resulted in huge expenditures to build up resort areas. It has developed new towns and has brought an active and wholesome spirit of competition among cities, areas, and states for a share of this new business.

Modern hotels with good service are found even in many small communities along main highways, constructed and operated to meet the demands of tourists and vacationists. The tourist camp or trailer camp has evolved from a mere overnight parking space with but minor conveniences to cabin and cottage camps which, in some cases, offer very attractive ac-

commodations. The "tourist home" or lodging has also become popular. The rapid growth of these forms of lodging has led to a demand in some states for rigid inspection and control, to assure proper sanitary and physical standards.

Millions of dollars have been invested in resort areas, golf courses, various sport facilities, and other attractions for the automobile user. In fact, one would find it difficult to name any business or industry in which employment and prosperity have not been directly or indirectly affected by motor vehicle transportation.

The Automobile and Crime

The automobile is a direct factor in law enforcement. Legal cases involving automobile thefts, other crimes, traffic violations, and automobile accidents have naturally increased with the rapid growth in the use of cars.

In some ways the automobile has made crime easier. With good roads and fast cars, the criminal has gained easy access

FIG. 11. Police radio communication greatly increases our protection.

to the small town and open country. And the automobile has aided him in making a quick "get-away" to distant hideouts.

Car thefts, however, have materially decreased in many places because of better laws, new police enforcement methods, use

of radio-dispatched police cars, better locking devices for cars, and greater precaution by drivers.

Protective Services of the Auto

Law enforcement officers are greatly aided by motor vehicles. Radio-equipped police cars, dispatched by means of efficient police broadcasting stations, frequently enable policemen to capture criminals before they can make their "get-away." Fleeing criminals are often caught in a radio-arranged dragnet. Two-way radio equipment, permitting officers in police cars to report to and answer questions from headquarters, is now extensively used.

Motorized patrol wagons, squad cars, and motorcycles speed to places where police are needed. The area that can be policed by a given number of officers has been greatly increased. Suburban and semi-rural districts now enjoy police protection that would not be possible without highways and motor vehicles.

Fire departments move motorized apparatus quickly to places far removed from fire stations. Thousands of rural and suburban homes, which once would have been doomed if fire broke out, are now protected.

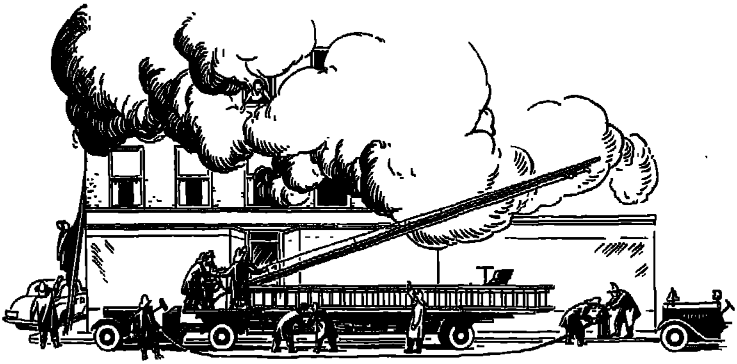


FIG. 12. Fire! Sirens scream as motorized fire apparatus speeds to the scene. The first few minutes after the alarm are vital. Why?

Safeguards for life have been extended. The motorized ambulance quickly answers a call of distress. Physicians and

nurses travel rapidly to scenes of disaster. The car enables the family doctor to visit many more patients and to meet an emergency much faster than his predecessors in the "one-horse-shay."

Over 2,000,000 military trucks of 226 different types were produced for the armed services in World War II.

Spectacular advances in recent warfare have closely coordinated the work of mechanized units and aircraft. Motorized units move artillery and other heavy military equipment, and mobilize and transport troops. Radio-equipped cars control the movements of convoys and are very important in battle. There are motorized kitchens, bath-houses, supply units, trucks, ambulances, and command cars.

Huge searchlights are rapidly moved by motorized units to desired locations, where electric power for their operation is generated on mobile, motor-driven power plants. Accompanying anti-aircraft equipment, brought up by motor vehicle, can be quickly placed in operation where it will be most effective. Mechanized tanks and flame-throwers have become the spearhead of "blitz," or lightning-fast, military operations. Some of the heavily armored tanks have earned the name of mobile land forts.

With their all-wheel drives, motorized units are not limited to the highway. They are built with the power and traction to go across country where getting through would seem impossible. Land operations of the navy and marine corps also make full use of motor transportation.

The protective service of motorized units was indeed spectacular during World War II.

Unfortunately, however, the automobile is not always used with control. At such times it is anything but protective.

MOTOR ACCIDENTS

The automobile has greatly increased the hazards to life, limb, and property. In 1946 more than 1,200,000 people in the United States were injured in motor accidents; 33,500 met death. These figures mean that, in a year's time, in our use

of motor cars we are wiping out the equivalent of the entire population of a moderately large city.

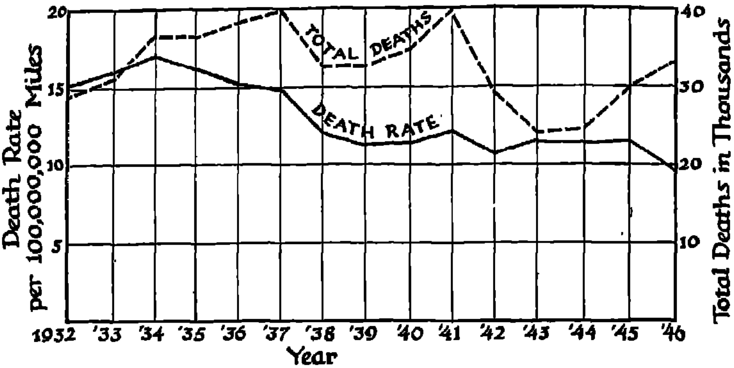
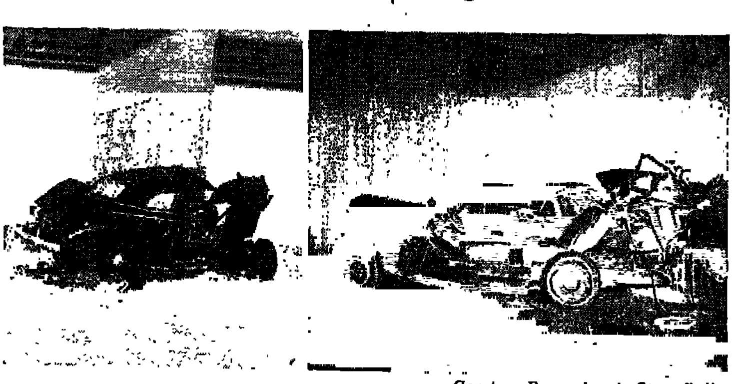


FIG. 13. Traffic deaths reached a peak of nearly 40,000 during 1937 and 1941. Deaths per 100,000,000 miles of highway travel, however, reached a peak in 1934, declined until 1939 to the rate of 12.0 persons, remained fairly constant during the war years and dropped to 9.7 persons in 1946.

The number of highway deaths in recent years has been appalling. In addition, over 100,000 persons annually have been permanently disabled and over a million have suffered lesser injuries in traffic crashes. Furthermore, it is estimated that for each fatal accident there are one hundred and fifty accidents involving only property damage.



Courtesy Pennsylvania State Police

FIG. 14. "And Sudden Death."

Neither numbers nor words can express the suffering and sorrow involved in these statistics. However, the annual economic loss to the American people has been estimated to be as high as two and a half billion dollars. This sum is greater than the annual cost of operating our public school system.

This is a large amount of money. But *no amount of money* can measure the value of a father or mother to the future of a family. No sum can be set to measure the value of the contributions that a young man or woman might make to humanity during a lifetime. The loss of them to society can never be measured in dollars alone.

Why do we have this destruction and maiming of human beings? Must we pay this price for the better transportation the automobile has brought? The history of the railroad would not indicate so. Thirty years ago our railroads were killing over 400 passengers a year. Then railroad companies made safety a major concern, and the number of accidents declined. Conditions on the highway are vastly different, but it seems reasonable to believe that the automobile accident rate also can be greatly reduced by the united efforts of all highway users.

Our most pressing motoring problem has become, "Can we learn to manage and control our cars?"

Where does the responsibility for solving this problem lie? It cannot lie with the car itself. It lies with the driver.

There is a vast number of drivers to shoulder this responsibility. Approximately every third person in the United States drives a car. Our total population is 140,386,509 people. We have 45,000,000 drivers of automobiles. We are a Nation of Drivers!

It seems, then, that the most important and difficult nut to be cracked in reducing traffic accidents is that of training good drivers. Drivers hold the principal key to the traffic situation.

When you become a driver you become a part of the complex, modern traffic picture. Whether you are a good or a bad part depends on the kind of driver you are. The kind of driver you are depends largely on how you learn to drive.

DISCUSSION TOPICS

1. Considering modern developments in power, can you describe more suitable units of power measurement than the power of a horse?
2. What adjustments would have to be made if suddenly there were no cars in your community?
3. Since the nineties, three new inventions—the automobile, the movies and the radio—have practically revolutionized our use of leisure time. What are some of the major changes brought about by each?
4. How have various types of business been affected by the automobile? Can you name any type of business not affected?
5. What are some of the evils that arise from traffic congestion? If you were a "traffic dictator" in your community, what would you do to eliminate or reduce congestion and still retain all the good the auto brings to your community?
6. Consider the number of persons injured and killed by cars in 1946. What cities have a population of around 1,200,000 and what cities around 33,500? Soldier Field in Chicago holds about 120,000. The Princeton Bowl holds about 40,000. Think of injuries and fatalities in terms of these crowds.
7. Compare the number of automobile fatalities in 1918, 1928, 1938, and last year with all other types of fatal accidents in your state or community. What seems to you to be the principal answer to the traffic accident problem?
8. What effects has the automobile had on construction of residences in your community?
9. Cite and discuss instances: (a) when the automobile is a civic liability, (b) when it is a civic asset. Can you defend the proposition that it is the driver who determines which it shall be?
10. Can you think of any other single invention that has so speeded up the tempo of American civilization as has the automobile? Are there any other inventions and discoveries that promise to speed it up still more?

PROJECTS

1. Make a survey among members of your group to determine how many parents or relatives work directly or indirectly for the automobile industry.
2. Visit a market to see the kinds of produce carried by trucks and to find out where the produce comes from and how long it was en route.
3. Visit a fire station to see the different kinds of trucks and to find out how each is used.

4. Visit a modern tourist camp to see how it is arranged. Observe from their license plates where the tourists are from. Find out what charges are paid by trailer owners; what features are offered.
5. Prepare a report on how the Interstate Commerce Commission regulates interstate trucks and buses.
6. Read "And Sudden Death," by J. C. Furnas, Reader's Digest, Dec., 1945. If possible, see motion pictures "And Sudden Death" and "Hit-and-Run Driver." Does driver training seem to you to be a matter important enough to be accepted as one of society's most serious modern problems?

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CHAPTER II

The Best Way to Learn to Drive

Do You Know:

How most people learn to drive?
What is wrong with the usual way?
What is the best way to learn to drive?
Whether driving is a "cinch"?

A FEW SHORT LESSONS!

HOW DO most people learn to drive?

Mr. Jones, let us say, buys an automobile. Perhaps he works out a driving technique largely by himself. Or perhaps a friend, who may have piled up a lot of bad driving habits and a bad accident record in his own driving, takes Mr. Jones out a few times and shows him which "gadgets" make the car go and which make it stop. Mr. Jones practices a little in traffic. He memorizes a few rules. He gets a license. Presto! He's a driver!

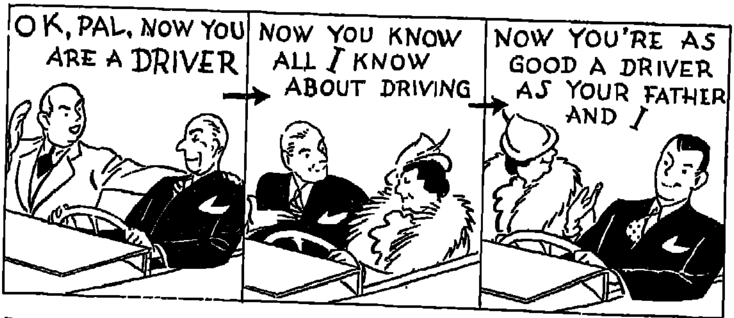

FIG. 15. A few driving hints and lo, you're a driver! What is wrong with this method?

If Mrs. Jones wants to learn, Mr. Jones teaches her all he knows about driving. Bill Jones, Jr., reaches high school age and inherits the combined automobile wisdom of the Jones family. He practices wherever and whenever he can, tries this method and that, and becomes a driver of sorts.

As well-meaning as the Jones family may be, this is a very sketchy, hand-me-down sort of training with which to meet the hazards and responsibilities of the modern highway.

What is wrong with the way the Jones family learned to drive? Is there any better way?

HOW WE LEARN

If you want to be a football player, a swimmer, a typist, or an automobile driver, you may try to learn by reading books or by watching others perform. You may read about Johnny Weissmuller's strokes and listen to experts' tips. But you cannot acquire skill merely by reading or listening. You can get some ideas about dancing form by watching Fred Astaire. But that won't give you skill.

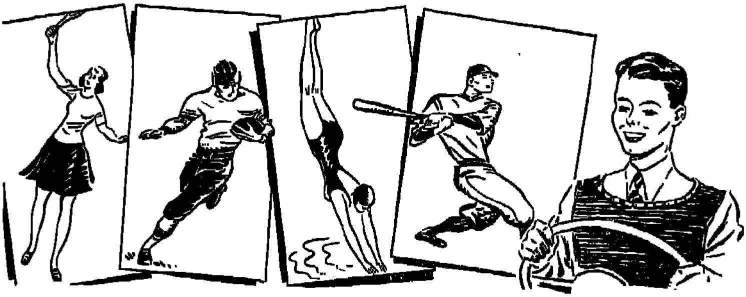

FIG. 16. Careful training is the way to high-quality skills.

In the end, skill has to be learned by each individual's own practice. You learn to do a thing by doing it. Furthermore, you learn to do exactly what you practice. Just *how* you practice makes a lot of difference.

Trial and Error Practice

Practice without guidance is learning by trial-and-error. That's a good name for it. It is a hit-or-miss process of trying first this method and then that, until finally, by accident, luck, or "common sense" you find something that works. This is the procedure that beginners, left to themselves, almost always follow.

But trial-and-error learning wastes time and effort, and gives no assurance that the learning will ever be of high quality. It is a method that is likely to produce "dubs". It is certainly not the best method to follow when learning to drive a car because:

1. Wrong driving habits, once learned, must then be unlearned.
2. Wrong habits may not be recognized and corrected.
3. Traffic accidents can be traced, in large part, to faulty trial-and-error driver training.
4. Increasing traffic volume requires more carefully trained drivers.
5. Improved driver training methods have been developed and are now available.

Haphazard learning never promises a high grade of skill. Furthermore, in trial-and-error learning, there are generally a great many errors before you are even halfway skilled. Errors are not fatal if you are learning to play the saxophone, drive a golf ball, or do the latest dance step. The family may suffer, as will your disposition! But all will recover.

Learning to drive a car, however, is a different matter. It involves the safety of everyone within hitting distance of the driver. The welfare of the general public is involved. So, if possible, a "fool-proof" training method must be found.

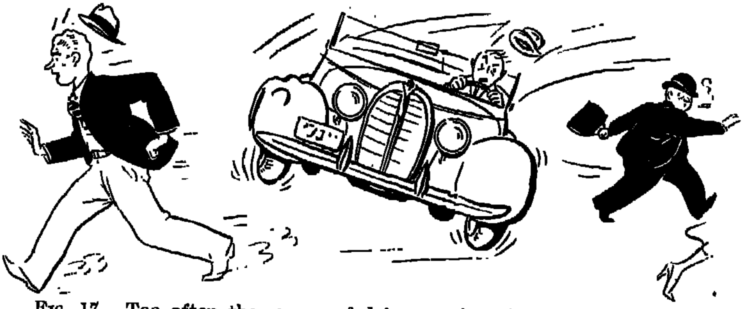

FIG. 17. Too often the errors of drivers using the trial-and-error method result in damaged property and death or injury to others.

Guided Practice

The best substitute for trial-and-error learning is practice under expert guidance. Guided learning takes place more rapidly than other kinds of learning and produces a greater degree of skill.

You have seen this work out yourself. Suppose you and John Smith start learning to swim at the same time. You both have the same amount of natural ability. However, you "pick up" the sport while John gets it from a "pro." It won't be long before John will be too good for you.

Champion tennis and golf players "get there" five to ten years younger when they have good guided training. They take a short cut. They learn the right way from the beginning. Good coaching shortens the learning process. Time is wasted if bad habits are practiced, for they must later be unlearned.

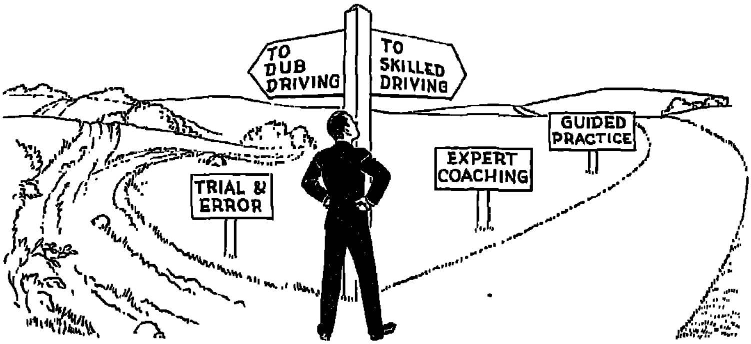

FIG. 18. Which road will YOU take?

People who "pick up" their knowledge of driving by the hit-or-miss style seldom understand their automobiles well. Practice gives them some degree of skill in handling controls and devices. But their knowledge of the machine they are handling is often very superficial and imperfect. And, instead of having a reliable system of good driving habits, their driving practices in traffic are likely to be inconsistent and confused. They upset the orderliness of good traffic patterns.

On the other hand, drivers who are given guided road training under expert supervision learn correct driving techniques.

They know their cars well, understand the responsibilities of driving, and help keep order and safety in the traffic pattern. It is generally easy to spot properly trained drivers.

What makes a good driver? What, a poor one? It is more and more evident that the difference between a good and a poor driver depends to a very large extent on *the way he learns to drive.*

EDUCATING DRIVERS FOR THE MOTOR AGE

Society is at last awakening to the fact that driving an automobile requires special attitudes and skills that should be learned in school classes under expert guidance.

Public education is supposed to be designed to equip young people for the activities and responsibilities they are almost certain to have to assume in their daily lives. Most young people are certain to drive cars on public streets and highways. This means that the general public will be endangered by their mistakes if they are not trained well. Society must not neglect to supply and support the best possible training.

The accident records of poorly trained young drivers have been bad. Figure 19 shows how very much worse is the *fatal accident* record of the young than of the mature driver.

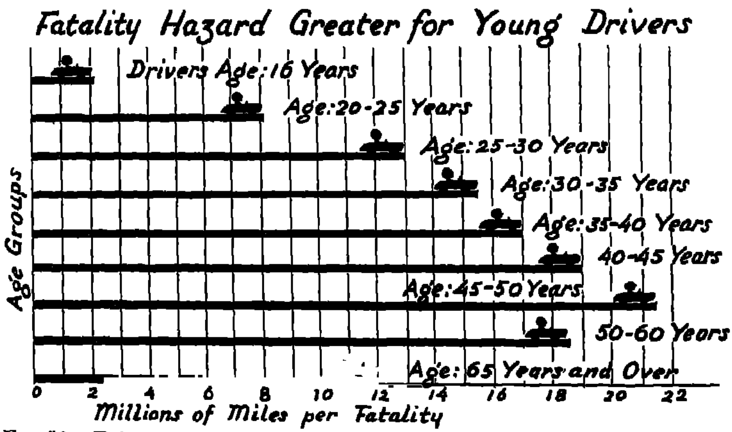

FIG. 19. Drivers 16 years old had a driving record over 9 times worse, in terms of fatalities, than persons 45-50 years old who had the best record.

The young driver has another personal reason to be interested in improved driver training. Over a period of 22 years his age-group has had a greater increase in traffic deaths than any other age-group.

When you study the chart below you will notice that:

1. For the age-group 5-14 years the death rate decreased substantially—33%.
2. For the high school and college groups aged 15-24, there was a serious increase in the death rate—90%.
3. For the group aged 25-44 there was an increase of 43%.
4. Other age-groups showed little change over the 22-year period.

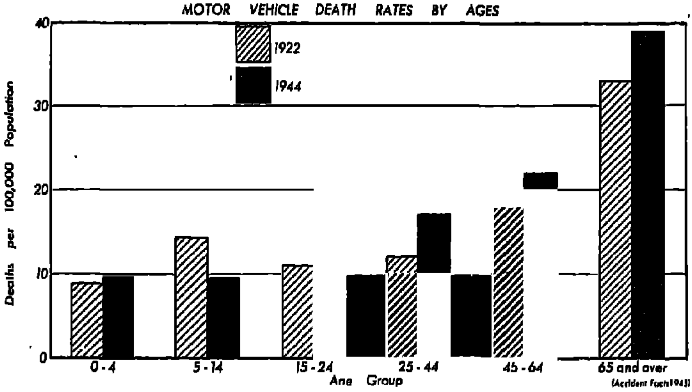

FIG. 20. In the last 22 years the traffic death rate of young people between the ages of 15 and 24 increased 90%.

Young drivers can themselves improve the situation. Their number is rapidly increasing. If they are systematically trained, they can correct this serious traffic condition. The situation is a challenge to society's educational program.

There are many good reasons why scheduled, systematic training in driving should be a regular part of public school education:

1. We live in a Motor Age.
2. Most young people of high school age are ready and eager to learn to drive.

3. It is right that education at public expense should be given in the activities that affect the welfare of the public.
4. There are few high school subjects that will prove more useful than learning to drive, or that will be put more immediately into practice.

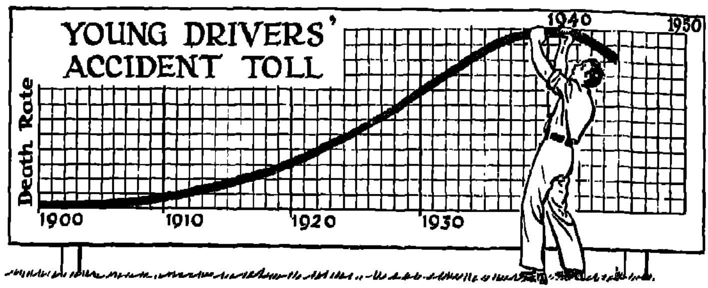

FIG. 21. Young sportsmanlike drivers will bring the toll down.

5. Poorly trained young drivers have a very bad accident record.
6. A properly trained generation of new drivers is the best promise for a lower accident rate in the future.
7. Good courses in driver training have now been worked out and are being successfully administered in many high schools throughout the country.

Five distinct groups are in need of sound, well-guided driver training programs:

New young drivers
New adult drivers
Violators of traffic regulations
Accident repeaters
Commercial drivers

Driver Training in High Schools

More and more high schools are giving instruction in traffic, safety, and driving.

High school youths need special education programs to train

them for modern traffic conditions. For they are the ones who will determine the traffic conditions of the future.

A good high school driver training course develops right attitudes toward driving responsibilities, instills an understanding of traffic regulations, and creates good traffic habits. High school teachers are becoming so interested in this new work that hundreds of them are taking special training courses to fit them to do a better job.

FIG. 22. A lively, interested group in a Cleveland high school driver training class.

In addition to classroom work, student projects, and club activities, some high schools are giving instruction in actual driving. "Dual-control" driver training cars, equipped with extra clutch and brake pedals, enable trained instructors to avoid troubles from mistakes made by learners. Guided road practice of this sort builds better skills.

Sound high school driver education and training produce good results. A study made in Pennsylvania compared the driving records of two groups of high school students. One

group of 250 students had received driver training in high school; the other group of 250 had not. The untrained group had 13 accidents, in 9 of which the driver was declared legally at fault. Eleven persons were injured in the 13 accidents. During the same period, the trained group had 5 accidents,

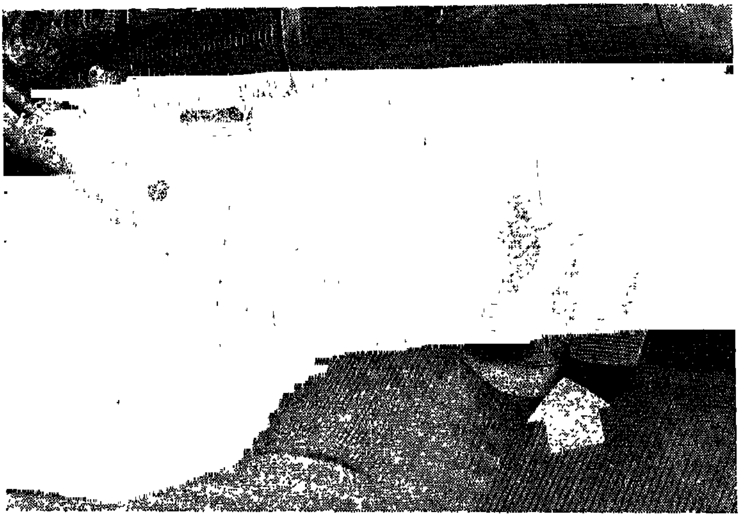

FIG. 28. Basic dual-control for driver training.

in which no injuries resulted and only two trained drivers were held legally responsible.

The effectiveness of classroom driver instruction and behind-the-wheel training shows also in a survey of the accident records of 3,252 Cleveland high school students, all of whom received driver licenses. Their accident and conviction records were checked for six months after their graduation. The *trained students* with behind-the-wheel instruction *had only half as many accidents* as the untrained group. Good training fortifies the young driver against traffic troubles.

New Adult Drivers

States with well-administered license laws require all new drivers to prove that they know important traffic laws, under-

stand signs and signals, and can drive reasonably well. Licensing tests are not sufficiently complete, in the opinion of many traffic specialists. Where they are well worked out, they have a decided educational value.

We need a large number of driving schools for new drivers to whom high school driver training classes are not available. Fortunately there is a distinct trend toward more adult driver training under trained responsible instructors.

Violators and Repeaters

Certain violators and accident repeaters are more in need of instruction than of punishment. For this reason, some judges send violators to violators' schools in lieu of being fined. These schools, if well conducted, produce good results.

Specialized attention is given to drivers whose records show that they are exceptionally prone to accidents. Very often the driver who repeatedly gets into traffic troubles does not himself understand the causes of his difficulties. He needs a diagnosis by a competent "trouble shooter."

"Trouble Shooting" is an attempt to find out why a certain driver has repeated accidents by giving him physical and other tests, by interviewing him, and by observing his driving habits. When the trouble is discovered he is shown how to overcome his difficulties.

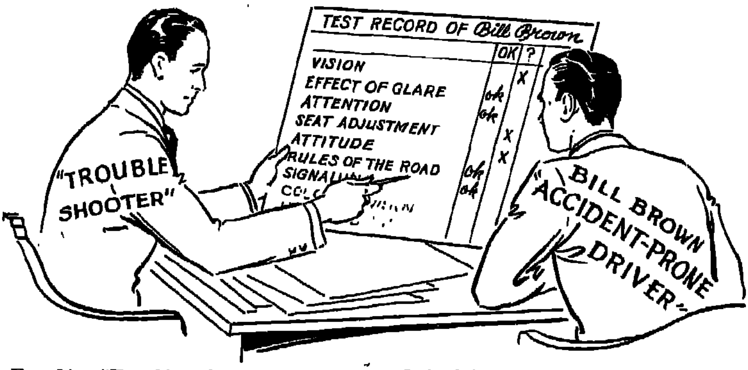

FIG. 24. "Trouble Shooters" diagnose difficulties and prescribe remedies for "sick" drivers.

Relatively little has been done in "trouble shooting," but much more will be done in the future. Techniques will be better developed. Drivers will learn to welcome such a thorough diagnosis. Officials will insist that once the causes of a driver's troubles are discovered, he will receive whatever training is necessary to correct them, if his license is to be continued.

Commercial Drivers

The fatality toll among commercial drivers has decreased sharply with the large increase in deaths caused by passenger car drivers.

This improvement has been brought about by good car maintenance, *careful selection and training of drivers,* good supervision, discipline where needed, and contests and awards to stimulate interest.

Safe driving contests among fleet drivers have been found to keep them "on their toes" and eager to beat other fleets or competing groups. Human nature works harder when recognition and a reward or prize can be won. The person who develops a good, workable plan for appealing to this human trait with passenger car drivers will make a valuable contribution to traffic safety.

FIG. 25. Competition has improved commercial driving!

The fine no-accident records that have been established by some commercial drivers are nothing less than an inspiration.

One truck driver is known to have driven 1,707,800 miles in 15 years without an accident! Others have covered 500,000 miles in 6 years, 231,000 miles in 5 years, and 256,000 miles in 6 years, without accidents. Good training programs and sportsmanlike driving are giving us a group of expert commercial drivers with very enviable safety records.

IS DRIVING A "CINCH"?

Driving skilfully in modern traffic is no "cinch."

The mechanical maneuvers that are necessary in starting and stopping a car and shifting its gears are not at all difficult for most people to learn. These things easily become habits. When the mechanical side alone is considered, driving does not appear to be much of a task.

But there are at least five important factors, other than mechanical adjustment, that tend to make the skilful driving of an automobile a challenging job:

1. The power and limitations of the car itself
2. The physical features of roads and streets
3. The behavior of other highway users
4. Changing light and weather conditions
5. The make-up of the driver himself

The driver himself is one of the most complicating of the factors which keep driving from being a "cinch." Automotive engineering may make the car easier to drive; highway engi-

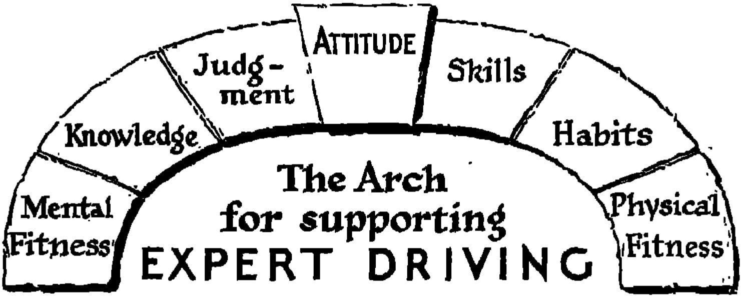

FIG. 26.

neering may make the highway safer to use; safety education may result in greater care, common sense, and cooperation in the shared use of the highway; illuminating devices and clever inventions may help overcome unfavorable weather conditions; but, with all such improvements, driving cannot be a "cinch" because it demands always that the driver keep in first class physical condition, have sound skills and habits, and drive with sportsmanlike ATTITUDES.

One of the first things a new driver needs to learn is to recognize the ways in which his own make-up and physical condition will affect his ability as a driver. He should be aware of how much his skill and sportsmanship as a driver depend on such things as his eyesight, hearing, health, reaction time, and psychological well-being.

DISCUSSION TOPICS

1. Since you learn to do a thing exactly as you practice it, show why you should have proper driving instruction from the start.
2. Give illustrations of skills you have only poorly formed because you "picked them up" yourself and were not properly coached.
3. Suggest emergencies which a driver who is well informed about the mechanics of automobiles would be better prepared to meet.
4. Why does a good football coach give blackboard talks and demonstrations of different plays before practicing them on the field? Why does he have his team practice these plays over and over again before using them in actual games?
5. Discuss the statement, "You cannot acquire skill just by reading, listening and watching." Illustrate.
6. Why is it more important from a social point of view to be an expert driver than an expert swimmer or tennis player?
7. Why have so many people learned to drive in a haphazard manner?
8. Discuss the probability that more restrictive driver regulations and increased police enforcement will result if young drivers do not assume attitudes of good sportsmanship.
9. Why should systematic, supervised driver training be a required part of tax-supported, public school education?
10. Discuss the advantages of a dual-control car (a) from the point of view of the learner; (b) the instructor.

PROJECTS

1. Ask several passenger car operators how they learned to drive an automobile. Pool your findings with those of others in your group and make an analysis of the methods by which the present generation of drivers has been prepared. What probable relationship is there between the preparation of these drivers and the number of traffic accidents on our streets and highways today?
2. Interview several drivers in well-managed trucking fleets and ask them what training they received before making their first run alone. Contrast their training with that found for the group interviewed for project 1.
3. Obtain the accident records for passenger car operators of your state. How do their records compare with those of bus, truck, and taxicab operators? Can you explain these differences?
4. If a friend of yours wished someone to teach him to drive, where would you recommend that he go? List the places in order of your preference.
5. Make a list of what you would consider to be sportsmanlike driving attitudes. Make similar lists for the other blocks of the Arch for Supporting Expert Driving, as shown in Figure 26.

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CHAPTER III

The Eyes of a Driver

Do You Know:

How important eyesight is to driving?
What every driver should know about his eyes?
How you can test for visual defects?
How to correct or compensate for visual defects?

GOOD EYESIGHT AND THE DRIVER

IN MOST states, your eyes are tested when you are examined for a new driver's license. If you wear glasses, your eyes are tested both with and without them. How well you see will determine whether you will be required to wear your glasses when driving. Without question, good vision is one of the most important qualifications of the driver.

Where the moving automobile goes depends on the driver. What the driver does depends, to a large extent, on what he learns through his eyes about the changing traffic situation. Sight of danger, for instance, is the signal which sets off the stopping reaction. Countless reactions which the driver makes depend on the sight signals he gets. These sight signals must therefore tell the truth, and tell it quickly.

When eyes have normal vision, the signals do tell the truth. But the eye is a delicate organ with many parts, and parts may work imperfectly. When they do, the result is an unsatisfactory sight cue and a delayed or faulty reaction, followed by an emergency, or even an accident.

Eyes furnish the signals for action regarding:

Distances
Speeds of other cars or of pedestrians
Color of traffic signals
Meaning of traffic signs
The number, position, or movements of objects approached or approaching

Accurate sight signals mean better judgment and therefore better driving.

If your eyesight is not perfect and your visual cues are likely to be delayed or incorrect, certain precautions must be taken to make your driving safe:

1. Consult a competent oculist or optometrist immediately about having your faulty vision corrected. Faulty vision may sooner or later involve you in an expensive, if not fatal, accident.
2. Learn the nature of your eye defect. Know what kind of misjudgments you are liable to make, and be on guard against them.
3. Learn how to compensate for uncorrected eye defects. Compensation generally means *slower driving* and *greater alertness*.

Fig. 27. The picture at the top shows what a person with clear vision sees. The bottom picture gives an idea of what a person with poor or blurred vision sees.

HOW THE DRIVER'S EYES MUST FUNCTION

1. Clearness of Vision

The most obvious function of your eyes is to give a clear picture of what is in front of you. Your ability to see details

is called *visual acuity*. People differ considerably in their visual acuity. One person may be able to read a highway sign from a distance greater than 50 feet while another may not. Many people have vision considerably below normal without realizing it. They have never had a chance to test their vision and compare it with that of others. Fortunately, it is not difficult to test for visual acuity. Carefully drawn letter charts have been prepared for this purpose.

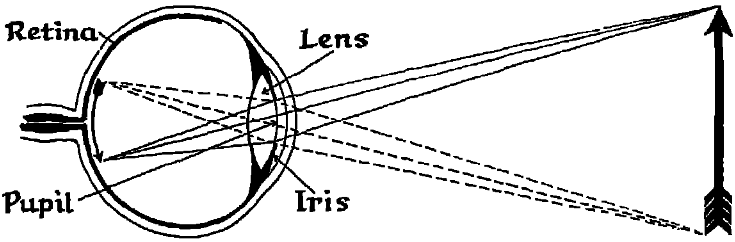

FIG. 28. When any part of the eye works improperly, you get driving "signals" that are inaccurate or too late.

Test for Clearness

The person with normal vision can read standard Snellen letters that are 0.349 inch high at a distance of 20 feet. This is called 100% vision or 20/20 vision.

Most Snellen charts consist of several rows of letters of various sizes, and your visual acuity is scored by the *size* of the smallest letters you can read. With other charts, your score may be determined by the *distance* at which you can read the letters.

C O Y P F

D Z N E R

FIG. 29. Measure your visual acuity by the distance at which you can read these letters. Follow the directions in the text.

Use the chart in Fig. 29 to test your vision. Have it held in good light about 15 feet away. Cover one eye with a card

and walk slowly toward the chart until you can read 8 letters out of 10 correctly. Carefully measure the distance from your eyes to the chart. Multiply this distance in feet by 10 and you will have your visual acuity rating in per cent.

If you can read the letters at 10 feet, your vision is normal. It is then called 100%, or 20/20 vision. If you can read the letters at 12 feet, your rating is 120%. If you can read them at 8.5 feet, your rating is 85%, or below average. You can test the other eye in the same way, except that you should read the letters backward to eliminate the factor of memory.

If your vision is appreciably below normal (75% or below), consult an optometrist or oculist. While a visual acuity of 75% is not a serious driving hazard, your vision can probably be improved by proper treatment or glasses. Early correction of slight visual defects may prevent them from becoming serious.

State licensing agencies consider visual acuity of such importance that over two-thirds of them have established minimum standards. The most common minimum requirement is 20/40, or 50% vision.

2. Seeing Out of the Corner of Your Eye

If you wish to see details, you look directly at an object. But you can see objects in less detail over a wider field. In other words, you can see "out of the corner of your eye." The distance you can see to either side, while looking straight ahead, is called the *field of vision.*

People differ in this use of the eyes. That is, some people have a wider field of vision, or see farther to the side, than others. In the case of the driver, it is greatly to his advantage if he can detect objects over a wide field. He can more quickly detect cars coming up to pass him and objects approaching from the right or left.

Your best *peripheral,* or side, vision is for moving objects. You cannot recognize stationary objects or color out of the corner of your eye nearly so well as motion.

A few people are limited to such a narrow visual field that they have what is known as "tunnel vision." They see only

straight ahead, as one would if he were looking through a tunnel. They are at a great disadvantage when cars are overtaking them, when they are driving through street intersections, and when they are in heavy traffic.

Test for Field of Vision

You can test your field of vision by making a simple cardboard protractor with a radius of 10 inches. (See Fig. 30.) When held up to the bridge of your nose, the 0 should be directly ahead and the 90° marks to the right and left. Now look at a fixed point some distance straight ahead. Have someone move a pencil slowly from back to front along the edge of the protractor until you can see the pencil out of the corner of your eye while still looking straight ahead. Note the reading in degrees. Take several trials and determine the average for each side. The sum of these two figures will indicate your total field of vision.

Most people can see at least 90° to each side, making a total field of vision of over 180°. A field of less than 140°

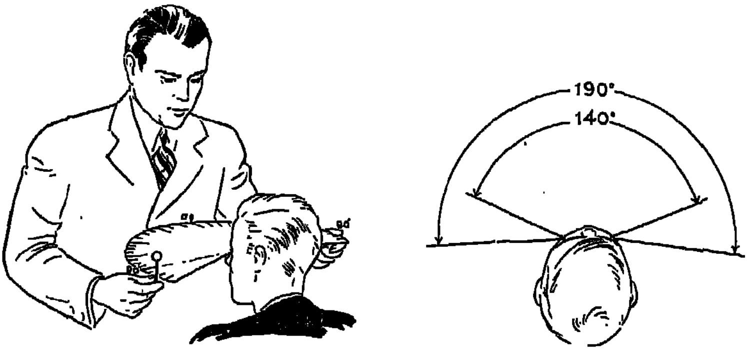

FIG. 30. Measuring the field of vision.

is generally considered a serious handicap to safe driving. However, a person who is conscious of this handicap can do much to compensate for it by:

1. Reducing speed where vehicles or pedestrians might be approaching from the side.

2. Using a rear-view mirror on the left.
3. Turning his head slightly to look both ways at intersections and at other dangerous points.

3. Judging Color

In a large number of traffic situations, color is used to give information to the driver:

Red and green "stop" and "go" signals
Red lanterns at roadway hazards and obstructions
Red flags for directing traffic
Red flags to show extended loads on the ends of trucks
Red tail-lights on cars
Yellow or red blinker lights at dangerous crossings
Yellow, green, or red identifying lights on buses and trucks
Colored road signs

Persons unable to distinguish the various colors used for traffic situations are definitely handicapped. It is estimated that about one person in 20 has some difficulty in distinguishing certain colors. It is also estimated that defective color vision is about 5 times as frequent among men as among women. Fortunately, the percentage of drivers who have difficulty in distinguishing red and green traffic signals is very small.

If tests show that you have a definite color weakness, *especially in red and green, learn to compensate for this deficiency.* Here is what you can do:

1. Keep a sharper lookout for signals at intersections.
2. Pay closer attention to the actions of other drivers at intersections with traffic signals.
3. Know the arrangement of signals in localities where you do your driving. In many states and cities, signal positions are in accord with the national standard—red at the top, green below. Unfortunately, position cannot be relied upon in strange territory, for there are still many places with a non-standard arrangement.
4. Learn to interpret the shape of traffic signs as guides for what to expect ahead. Learn what the different shapes of signs—circle, octagon, diamond, and oblong—signify.

5. Avoid rear-end collisions at night by keeping more than the accustomed "safe-stopping distance" away from the car ahead.

Test for Color Vision

A color-vision test commonly used is the Ishihara test. This consists of several circular areas filled with spots and dots of various colors. Spots of a given color are arranged in patterns to form numbers. Persons with defective color vision are unable to distinguish the figures from the background.

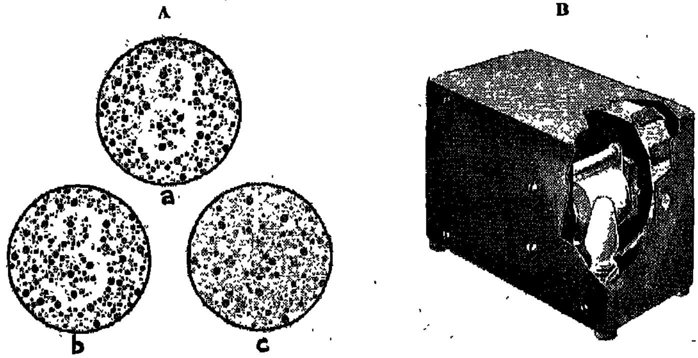

FIG. 31. Tests for color vision. A. An Ishihara test. (a) Persons with normal vision see a figure 8. (b) The red-green color-blind person sees a figure 3. (c) Persons totally color-blind are unable to see any figure. B. The Allgaier Colorater.

This test detects minor degrees of color blindness, many not serious enough to interfere with safe driving. For this reason, if the Ishihara test indicates a color deficiency, you should be tested with actual traffic signals at night and during the day. The colored signals should be shown one at a time so that you cannot tell the color by the position.

A new device for testing color vision is shown in Fig. 31, B. This test requires the same kind of color discrimination that the driver must show in reading traffic signal lights. A small motor within the box turns a disc containing sections of glass of the same colors as are found in traffic signals. A light illuminates each section as it becomes visible through a small opening. The colors appear in random order, each exposed

for about two seconds. To pass the test, you must name them properly as they appear.

4. Judging Depth

In normal vision, you see an object in three dimensions. You are able to judge size, shape, and distances.

A person with faulty depth perception cannot judge distances accurately. He may overestimate the distance of an approaching car and attempt to pass a car directly ahead when there is insufficient room. Or he may make an unnecessarily sudden stop, thinking the car ahead is actually closer than it is.

Test for Depth Perception

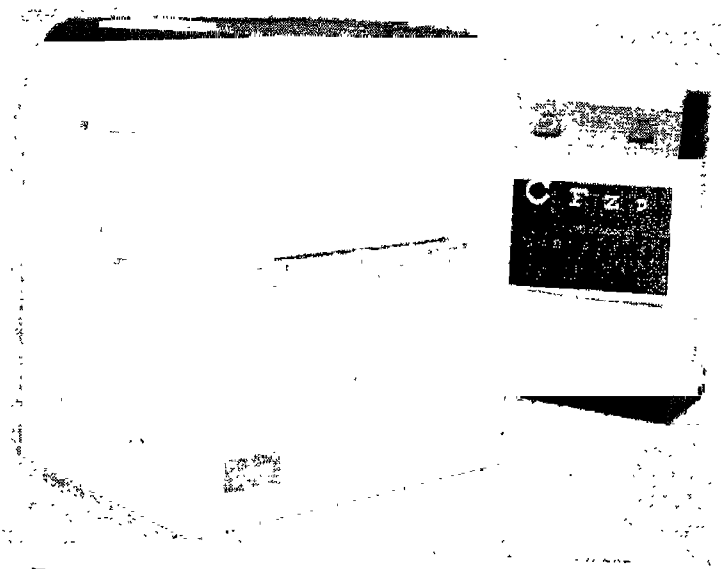

FIG. 32. Ability to judge distance is measured by lining up toy automobiles until they appear to be side by side and then recording the error.

One of several tests available for measuring depth perception is illustrated in Fig. 32. When you look into this test you see miniature cars in a mirror. The mirror is placed 10

feet from the test and the cars appear to be 20 feet away. You move the cars forward and backward until they appear to you to be side by side.

Unless your depth perception is considerably below normal, you should have an error of less than one inch in lining up the cars side by side.

If you have below average ability in judging distances, you should allow exceptional space between your car and other cars on the highway. In other words, do not follow other cars too closely or overtake another car unless there is more clear space ahead than appears to you to be ample.

5. Seeing at Night

Your eyes must make an adjustment to allow you to see in different degrees of illumination. Like the diaphragm of a camera, the pupil of the eye controls the amount of light that enters. When you go from daylight into a dark theater,

FIG. 88. Glaring headlights! Depress your lights when meeting oncoming cars.

you find it very difficult to see at first, but gradually objects become visible.

Here is what happens. In the daylight, the pupil of your eye has contracted to prevent too much light from falling on the retina. (See Fig. 28.) Then, when you enter the dark

theater, the pupil opens up fairly rapidly to allow more light to enter. But the sensitivity of your retina has become dulled by exposure to the brightness of day, and while this sensitivity is slowly recovering your sight is dull.

The eye adjusts much more slowly to darkness than it does to light. In fact, although a major part of retinal recovery may take place in the first 10 minutes after you enter the dark theater, complete recovery may take as long as half an hour.

Even though your daytime vision is normal, you may have difficulty seeing objects distinctly at night.

Glaring headlights help complicate night driving.

Each time you meet the headlights of an oncoming car, your ability to see is greatly reduced. When approaching headlights are about one hundred feet away, it is very difficult to see objects beside or beyond the approaching car. Even after the glaring lights have passed, some time is required for your vision to come back to normal.

Be able to stop within the distance in which you can see clearly ahead. Too many drivers try to drive at night at the *same speed* as in the daytime, instead of with the same *factor of safety.* They *over-drive their headlights,* and hold to a speed from which it is not physically possible to come to a complete stop in the distance of their clear vision ahead. Then

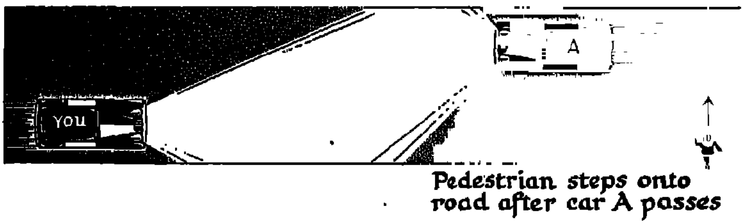

FIG. 34. This pedestrian steps into danger. Headlight glare may prevent you from seeing him.

in an emergency they are unable to avoid trouble. *Speed should always go down with the sun.*

The difficulties of night vision have to be taken seriously.

The fatal accident rate, on a mileage basis, is *three times* as high at night as it is during the day. Inability to see well enough is, without doubt, an important night-accident factor. You can lessen the accident danger in your own night driving:

1. Always depress your headlights when meeting other cars. This is not only courteous, but it lights the road directly ahead where you need it lighted.
2. Keep your headlights properly adjusted so that the depressed beams are not aimed at the oncoming driver's eyes.
3. Depress your lights when following another car. Otherwise your lights shining in his rear-vision mirror will blind him.
4. Look at the center line or the right-hand edge of the road, not at the headlights of the oncoming car.
5. Drive at night only after you have learned to drive by "feel" so that your eyes can be kept focused on the road ahead.
6. Keep your battery, lights, and electrical system in good condition.
7. Keep your windshield clean.
8. Avoid dark goggles or any other devices which reduce light.
9. Avoid lighting matches or using lights of any kind in the car. Inside lights reduce your vision.
10. Drive at night only when rested. Fatigue impairs your night vision.
11. Reduce speed when facing the glare from approaching headlights.
12. Know the visibility range of your headlights.
13. Be able to stop within the visibility range of your headlights.

Test for Night Vision

Ability to see at night varies greatly among individuals. Two persons may have the same visual acuity during the day,

and yet one of them may have much greater difficulty seeing at night.

Several tests have been developed to measure visual ability while driving at night. Some of these are designed for use in daylight and give only approximate scores at best. The most desirable type of test is one given after a person has been in a dark room for a half hour.

One of these tests is illustrated in Fig. 35. You look in one end of a dark box toward a disk with black and white stripes. Visibility of the disk is gradually increased by moving 4 radium buttons toward it until you can tell which way the stripes run. The distance of the radium buttons from the disk at this point gives the score.

By looking at a bright light and then taking readings on

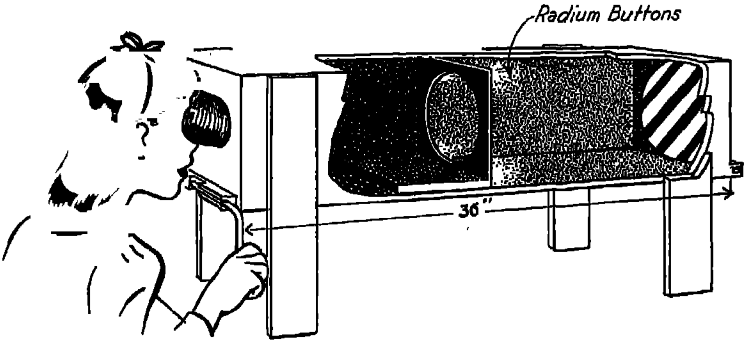

Fig. 35. This test measures how well you can see with very little light. It is given after you have been in the dark for 30 minutes.

this test, you can get a measure of your recovery from glare.

Some persons seriously handicapped by poor night vision find it necessary to avoid night driving entirely. Poor night vision is sometimes due to a vitamin deficiency. In such cases, addition to the diet of fresh vegetables, green salads, fruits, milk, cream, butter, cheese, eggs, meat, liver, and fish can improve night vision. For most people already on a normal diet, however, additional amounts of these foods or vitamin pills will be of little value.

DANGER IN EYE FATIGUE

Continuous use of the eyes for long periods of time puts a heavy strain on the muscles, and results in eye fatigue. This is especially true in driving, because of the constant strain of alert focusing for both near and far distances. A headache after a long drive is often a symptom of over-used eyes. Such fatigue can cause poor driving for the following reasons:

1. Tired eyes tend to bring on sleep. "Dozing at the wheel" is a known cause of many accidents.
2. Ability to judge depth is often reduced by eye fatigue. Most people have better vision in one eye than in the other. In case of eye fatigue, the dominant eye tends to take over the main burden of seeing. The result is something like one-eyed vision, and ability to judge depth and distance is greatly reduced in one-eyed vision.
3. When, in eye fatigue, the dominant eye takes over the burden of seeing, the field of vision is greatly decreased, and objects approaching from the side of the less-used eye are not so likely to be seen.
4. When fatigued, it is difficult to keep attention focused on the road ahead.

You cannot afford the risk of driving with tired eyes. In long drives, stop occasionally to give your eyes a rest. One way of helping tired, strained eyes is to lie down, close your eyes, and press your index fingers lightly over the eyelids. A few minutes of this simple treatment will prove surprisingly refreshing and will improve the character of your driving.

DISCUSSION TOPICS

1. Discuss the question: Should a person with 20/40 vision drive half as fast as a person with 20/20 vision?
2. What vision tests are required in your state before a license can be obtained? Discuss how the testing might be improved.
3. Discuss the advantages of a wide field of vision.
4. In what ways could a mirror help a person with a narrow field of vision?
5. Assemble clippings of traffic accidents and discuss the part that defective vision might have played in these.

PROJECTS

1. The letters in Fig. 29 are 0.175 inch high. How high would similar letters have to be in a traffic sign 200 feet away to be just readable to a person with 100% (20/20) vision? How large for a person with 40% (20/50) vision?
2. With the use of the chart in Fig. 29, carefully test each member of the class and make a table showing the visual acuity for each eye for each person.
3. Make a cardboard protractor as illustrated in Fig. 30 and measure the field of vision of each member of the class.
4. Secure the booklet "Plans for Building Driver Tests" and build one or more of the devices for testing the vision of members of the class.
5. The eye adjusts to light much more quickly than to darkness. If your eye is adjusted to darkness, it will require several minutes to recover the sensitivity lost by exposure to a bright light for only a few seconds. You can perform an interesting experiment to prove this. After spending 15 minutes in a dark room, cover one eye and shine a flashlight in the other for five seconds. After doing this, use one eye and then the other and notice the difference.
6. Seeing with two eyes, or so-called binocular vision, is a great help in depth perception. To illustrate, ask a friend to hold a pencil with the point up, about 30 inches from your shoulder. With your arm outstretched, hold your hand a few inches above the pencil; then attempt to touch the point with your index finger: (1) with the right eye closed; (2) with the left eye closed; (3) with both eyes open.

FOR FURTHER READING

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CHAPTER IV

Physical Fitness and Safety

Do You Know:

The effect your general health has on your driving?
What disabilities handicap a driver?
How you can compensate for disabilities?

GENERAL HEALTH

SOME seemingly insignificant part of a car can bend or break or lose its adjustment, and the performance of the whole machine will be affected. A driver is much like that. He gives a more satisfactory performance when all his parts are in first-class condition and working together smoothly.

A driver complains bitterly when vital parts like the carburetor or the timing gear or the bearings of a car are out of condition. It would be interesting if the car could complain of the driver whose "parts" are out of order!

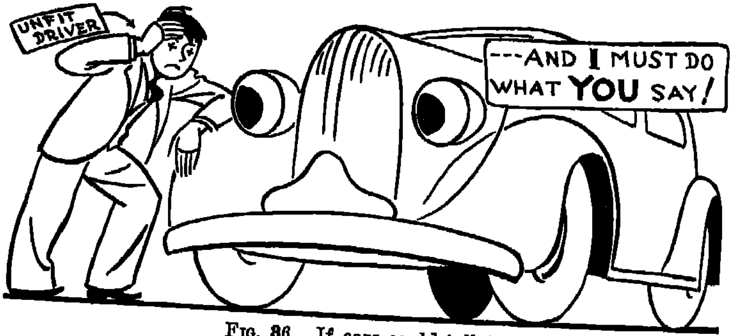

FIG. 36. If cars could talk!

Physical fitness means the proper working together of sound body organs. In such a condition one is at his best. He is efficient; his thinking is clear; his reactions are steady. His driving performance is much more likely to be reliable.

Major illnesses, such as influenza, ptomaine poisoning, fevers

and infections, impair one's ability to drive well for varying periods. Alertness is decreased, clearness of vision may be reduced, power of judgment lessened, and reaction time slowed down.

Even minor troubles such as worry, headache, a sore throat, or a throbbing tooth can be sufficiently unpleasant and distracting as to affect driving ability.

No one in poor health or in a worried, distracted condition should be driving an automobile. In case it is absolutely necessary to drive when in poor physical condition, only greatly reduced driving speed and exceptional caution can in any way compensate for the "run-down" condition.

DISABILITIES

Disabilities that can interfere with driving can be classified as follows:

A. Disabilities that permit correction or compensation
B. Disabilities that do not permit correction or compensation
C. Disabilities that temporarily disqualify the driver

At least four disabilities can be listed in the first group, five in the second and four in the last.

A. Disabilities That Permit Correction or Compensation

1. Defects of the Sense Organs

VISION. Defective vision can greatly handicap a driver, as was shown in Chapter III. You may be familiar with a driver who, because of defective vision, cuts in too quickly, backs into things, bumps into objects ahead, and endangers safety. Obviously, corrections or compensations should be made.

HEARING. Poor hearing can be a definite handicap to a driver. It may prevent him from hearing vehicles approaching, horns of reckless drivers, or horns of any passing cars. The

railroad grade crossing offers perhaps the greatest hazard to the deaf.

Persons who are *totally* deaf have ways of compensating for their deficiency. Since they cannot depend on hearing, they have to be exceptionally watchful, alert, and cautious.

The greatest danger lies with the *partially* deaf, or with those who have only recently become totally deaf and have not learned to compensate. The partially deaf are inclined to rely too much on their poor hearing. They owe it to themselves and others to adopt the policy of the totally deaf—that of being more watchful, alert, and cautious than persons with normal hearing.

The hard-of-hearing or the totally deaf driver can make certain compensations such as:

Using his eyes more extensively than the normal driver
Being exceptionally alert and watchful
Using an additional rear-view mirror
Employing devices which aid hearing

You can test your acuity of hearing by means of an audiometer, a device which measures the degree of deficiency in hearing. Or, you can use a simple watch test. Use a watch with a fairly loud tick. Determine the normal hearing distance for the particular watch used by taking the average for several people known to have good hearing. Test each ear separately by bringing the watch toward the ear until it can just be heard. A rating for hearing may be expressed as the ratio between the tested person's hearing distance and the normal hearing distance, stated in per cent.

2. *Advancing Age*

Advancing age can prove to be a serious driving disability. With it may come failing eyesight and hearing, high blood pressure and temporary lapses of attention. Stiffness of movement is likely to be found. Glare resistance and glare recovery may grow increasingly difficult. With advancing age also

comes slower reaction time. This does not mean that all young drivers have faster reaction times than older drivers. They do not. But each adult's reaction time tends to lengthen as he grows older. He cannot, with equal safety, drive as fast as he once could.

There are individual differences as to when age begins to interfere with driving efficiency. With some, such interference may be serious at 50; with others, not even at 65. The chief compensations for lowered efficiency due to age are lower speed and greater caution.

3. Deformities

Under right conditions, persons disabled by certain deformities can operate a car efficiently and safely.

In some states, a restricted license is granted persons with major deformities and disabilities. Such a license may permit driving when glasses are worn, when the car is equipped with an extra rear-view mirror, or when special levers, buttons, or extensions have been built into the car.

The war has produced so many veterans who have suffered losses of eyes, legs, arms or hands that automobile engineers and manufacturers, working with Army surgeons and orthopedic specialists, have designed clever new devices to give these veterans driving control.

New levers and switches have been designed. For instance, a single lever on the steering column can be used to operate the throttle, brakes, and clutch, so that a person without legs is able to drive. A special steering knob makes steering possible for persons with an artificial hand.

Drivers who have to use special devices to compensate for deformities *can*, with special training and *right driver attitudes*, achieve a safe degree of driving skill.

4. Muscular Weakness

Sufficient size and strength are clearly required to manipulate a car. An emergency may require a certain strength

of grip. By means of a hand dynamometer (Fig. 37), strength of grip can easily be measured. A strength of at least 60

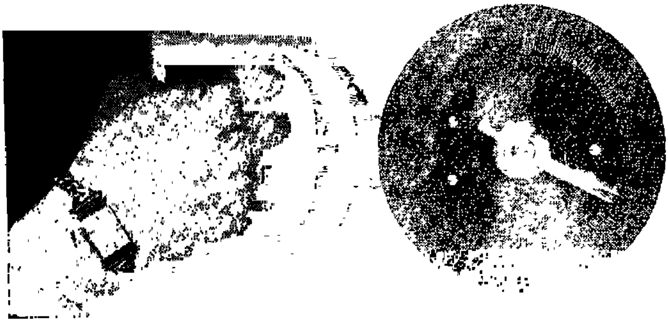

FIG. 37. What is your strength of grip? It can be measured by a hand dynamometer.

pounds in the stronger hand and 50 pounds in the weaker is considered a minimum for the safe all-around driving of a passenger car. Persons with less than this should drive only cars that brake and steer easily.

B. Disabilities That Do Not Permit Correction or Compensation

The value of the licensing program in your state depends on how well it sorts out those persons who very definitely should or should not be permitted to drive a car. An intelligent licensing program is sufficiently rigorous to keep people who suffer from the following disabilities from driving cars:

1. EPILEPSY. Sudden attacks may, at any time, result in unconsciousness. Minor epileptic attacks in the form of *petit mal* produce brief periods of unconsciousness of sufficient duration for a car to get completely out of control.
2. INSANITY. Mild insanities, difficult to detect, may be a menace to the safety of the highway. Definite insanities are prevented from being menaces by refusal of license.

3. PARALYSIS. The result of paralysis is loss of muscular control. Where certain muscles are affected, safe driving is obviously impossible.
4. SYPHILIS. Certain forms of this disease affect higher brain centers and result in paresis. A progressive childishness, unreasonableness, general loss of judgment, visions, and delusions may result. If the disease affects the spinal cord and lower brain centers, the result is *locomotor ataxia*, which incapacitates a driver.
5. HEART TROUBLE. Any serious heart disorder which is likely to cause sudden collapse makes a person obviously unsafe at the wheel. He should never drive.

C. Disabilities That Temporarily Disqualify a Driver

Certain physical conditions temporarily disqualify a driver:

1. Fatigue or Drowsiness

Fatigue can disqualify a driver.

As you work and exert your body, changes take place in the chemical make-up of your tissues. They collect "fatigue poisons." When sufficiently filled with fatigue poisons, you become drowsy and finally lose consciousness in sleep, even though you struggle against it.

Fatigue poisons make such important changes in the blood that extracts made from the muscles of a fatigued animal and injected into a rested animal will cause the latter to show signs of fatigue.

When you rest, your body produces chemical substances which counteract fatigue products, and it is only during rest that these substances can be supplied in sufficient quantity to restore your tissues to normal.

The poisons that cause fatigue slow down the working of the different parts of the body. The fatigued driver becomes less vigilant and loses judgment of depth, distance, and speed. His reaction time is slowed down. He is less able to resist glare. A study of interstate truck drivers by the U. S. Public Health Service shows the increasingly bad effects of long hours

of driving on these driver efficiency factors. Driving efficiency falls with increasing fatigue. Finally, nodding at the wheel is inescapable.

Cars that are wrecked with the driver asleep at the wheel are generally very badly wrecked because, during the period of unconsciousness, there is not even a small degree of control.

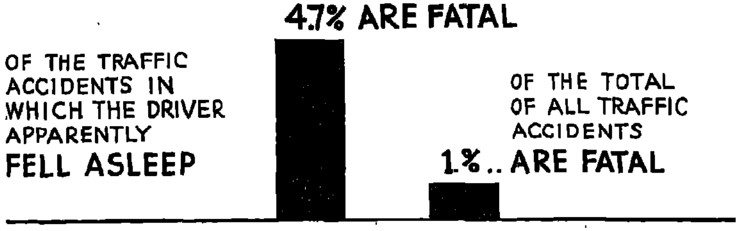

FIG. 38. "Asleep-at-the-wheel" accidents are usually severe. Why?

Drivers who have struggled against fatigue, determined to stay awake a little longer, have had so many and such serious accidents that, some years ago, certain progressive commercial concerns limited the number of consecutive hours their bus or truck drivers were allowed to drive. Then a few states adopted laws limiting driving hours. Since 1939 the Interstate Commerce Commission has limited the hours of driving by bus and truck drivers under their jurisdiction to ten, after which eight hours must be taken off duty. A passenger car driver should restrict himself as rigidly.

The chart (Fig. 39) shows how the accident rate varies according to the hour of the day and night. Accidents tend to increase as the day and evening wear on. They reach their peak in the early evening and remain frequent during the first half of the night. Of course, many factors are involved. Dusk and darkness bring greatly increased hazards. Drinking is more prevalent in the late afternoon and evening. Greater traffic volume increases accident probability. But *fatigue* is *an* important factor, undoubtedly accounting for some of the accident increase at the hours when people are fatigued from the day's work or from long driving. The later one drives, the

better his driving performance needs to be. The more fatigued he becomes, the less able he is to do his best at the wheel.

The only way to prevent crashes that are caused by fatigue is to refuse to drive when fatigued. Stop and rest, or turn

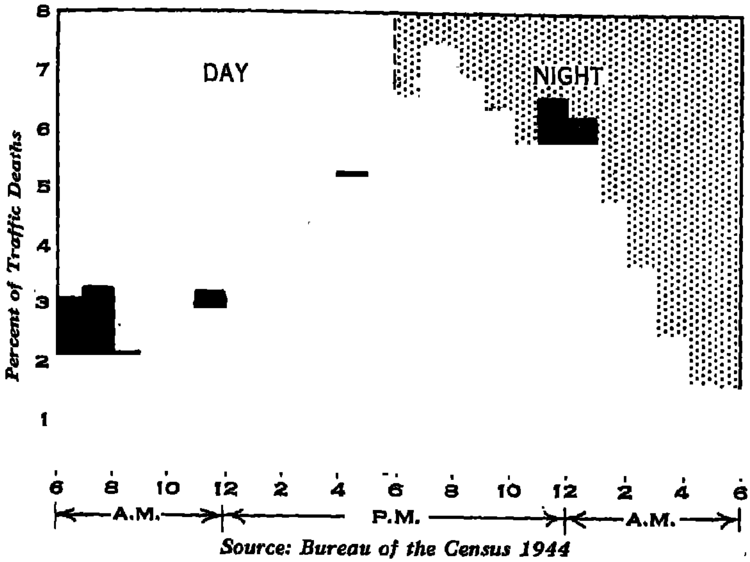

FIG. 89. Fatigue and darkness greatly increase accident risks. Note the rapid rise in fatalities in the late afternoon and at about dusk.

the wheel over to someone who is rested. Some drivers use the following means of offsetting drowsiness when they *must* drive longer:

1. Keep plenty of fresh air in the car—more than is needed for normal ventilation.
2. Engage in light conversation—especially toward the end of a long trip.
3. Pull off the road when drowsy, and take a nap.
4. Park the car, and rest the eyes by pressing the index fingers gently over the eyelids. Obviously this procedure has no effect on *general* body fatigue.

5. Drink coffee or strong tea to stimulate wakefulness. Avoid alcoholic drinks, which are sometimes thought of as stimulants but which are actually depressants, reducing alertness and weakening judgment.
6. Get out of the car every so often, or after a certain number of miles, and exercise by walking around.

2. The Influence of an Intoxicant

Alcohol is a depressant, first affecting the higher brain centers which control voluntary behavior and the emotions. Its use can disqualify a driver.

A good many psychological experiments have been made on the effects of using alcoholic beverages. These studies show evidence of decreased alertness and efficiency. There may be decreased self-consciousness, increased confidence, feelings of ease and of relaxation. But attention, judgment, and critical attitudes are impaired. Fear of consequences can be destroyed. This means that usual cautions are thrown to the winds. Habit systems are disorganized.

In driving, safety practices may be disregarded, and the driver may not be aware that he is disregarding them. In addition, his reaction time slows down (See p. 74, Chap. V). Normally quick reactions are not possible for him. To make matters worse, the driver is not likely to realize how much his reaction time has slowed down. Eye muscles can be so affected by drinking that the driver's vision is not normal. He cannot correctly judge the speed of his own or of another's car, nor correctly estimate distances being covered by each. He can become a highway menace.

Driving a car when under the influence of an intoxicant is *criminal* carelessness. In most states the penalty is severe.

Act V of the Uniform Vehicle Code, a legislative guide developed by those best qualified on highway problems, provides that every person who is convicted of driving a motor vehicle while under the influence of intoxicating liquor "shall be punished by imprisonment for not less than 10 days or more than 1 year, or by fine of not less than $100 or more than $1,000,

or by both such fine and imprisonment. On a second or subsequent conviction, he shall be punished by imprisonment for not less than 90 days or more than 1 year, and, in the discretion of the court, a fine of not more than $1,000. The commissioner shall revoke the operator's or chauffeur's license of any person convicted under this section."

To consent to ride in a car driven by a person who, although not drunk, "has been drinking," is unintelligent. He may be hilarious in spirit, but he is generally deficient in judgment, unreliable in reaction time, and not very alert. This combination is likely to produce an emergency when he is unfit to cope with one. A forced stop under such conditions often means disaster. Alcohol and driving simply do not mix.

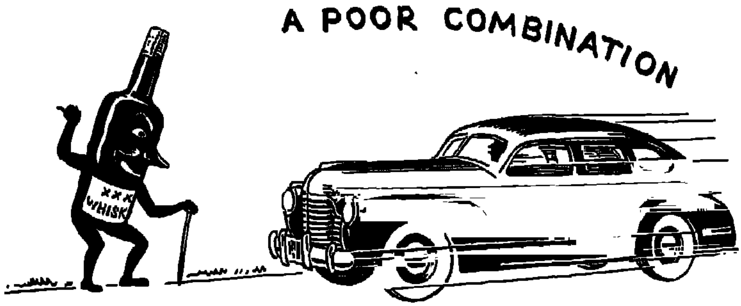

FIG. 40. Alcohol and driving make a poor combination.

Accurate statistics in regard to the number of accidents in which alcohol is involved are, at present, very limited. Certain studies which have been made indicate, however, that alcohol plays a considerably greater part in traffic accidents than is generally realized.

Tests for Intoxication

It is impossible for an intoxicated person to conceal his state when certain recently developed tests are made. Properly given, such tests protect the innocent and help convict the guilty by giving scientific evidence of the absence or presence of alcohol in the system of individuals suspected. Tests are

impersonal and impartial. They will be used increasingly to keep alcoholic drivers off the highways.

Alcohol requires no digestion. It is absorbed into the blood directly, rapidly and unchanged, from the stomach and intestines. The blood then carries it to all parts of the body.

Some of the alcohol is eliminated after drinking, in breath, perspiration, and urine. Some is converted, in the body, into water and carbon dioxide; some is destroyed by a process of oxidation.

Alcohol is absorbed so rapidly into the blood that it shows up in a minute or two after it is drunk. Because the rate of absorption is more rapid than the rate of elimination and oxidation, varying degrees of alcohol concentration appear in the blood. The amount of concentration in the blood depends on many conditions:

Amount of alcohol taken
Kind of alcoholic beverage taken
Amounts of other fluids in the body
Size and weight of the drinker
Contents of the stomach
Speed of the drinking
The time interval between the drinking and the tests for alcohol concentration

A measure of the concentration of the alcohol in a man's blood gives a measurement of his degree of soberness or intoxication.

Frequently in an autopsy, the brain tissue is examined to determine the amount of alcohol present. Fortunately, there is a close relationship between the amount of alcohol in the brain and the amounts in the blood, breath, and urine. So a satisfactory analysis can be made by determining the amount of alcohol in the blood, breath, or urine.

The breath test for intoxication is most frequently used. The person being tested blows up a toy balloon. This "breath" in the balloon is then passed through a solution of sulphuric acid and potassium permanganate in measured quantities. If alcohol is present, it is changed to acetic acid, and the chemical

solution changes from the original purple color to a light brown. The concentration of alcohol in the breath may be determined approximately by the volume of breath required to change the color of the solution. For more accurate measurements, a more complicated process is used.

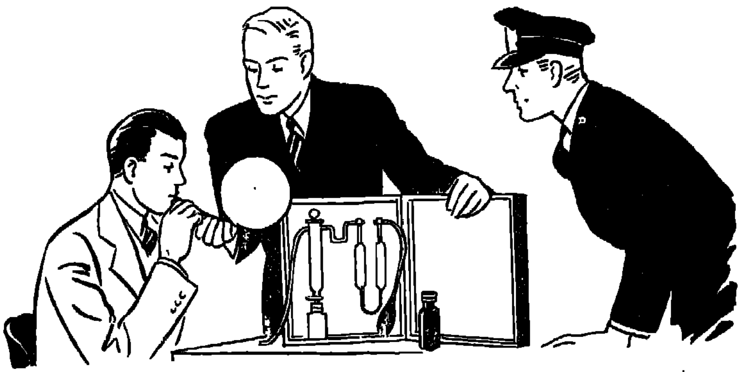

FIG. 41. Scientific methods are available for measuring the amount of alcohol in a person's system.

Medical and legal authorities generally accept a report of no more than 0.05 per cent of alcohol in the blood as evidence that a man is sober. If a man is of average size, this degree of concentration is generally not exceeded on drinking, on an empty stomach, 1 highball, 1 cocktail, or approximately 3 bottles of beer. Soon after a full meal, approximately double these quantities could be taken without exceeding the 0.05 concentration.

Either as a driver or a pedestrian, any one who uses alcohol should wait until the concentration of alcohol in the blood has fallen to 0.05 per cent before using streets and highways.

According to studies made by the Laboratory of Applied Physiology at Yale University, it is possible to know something definite as to the relation between the time that elapses after the use of alcohol and the percentage of alcohol concentration in the blood.

The following table from the Yale studies shows how much time must elapse after using certain kinds and amounts of alcohol before the concentration drops to 0.05 per cent.

The figures apply to a man of average weight—154 pounds—who drinks the beverage within a short time and on an empty stomach. A highball and a cocktail are taken to contain $\frac{3}{4}$ fluid ounce of alcohol (i.e., corresponding to about $1\frac{1}{2}$ ounces of whisky). A bottle of beer contains 12 ounces of beverage.

BLOOD ALCOHOLIC CONCENTRATIONS

AMOUNT AND KIND OF BEVERAGE	TIME AFTER DRINKING WHEN THE CONCENTRATION DROPS TO 0.05%
1 highball* or 1 cocktail* or 3 bottles of beer* (about 4 glasses)	The concentration of alcohol in the blood will reach its maximum in $\frac{1}{2}$ to 1 hour. This will be at or below a level of 0.05 per cent.
2 highballs or 2 cocktails	The concentration in the blood will reach a maximum slightly above 0.05 per cent but will fall to this level within 1 hour.
3 highballs or 3 cocktails	The concentration will fall to 0.05 per cent in 2 to 3 hours.
4 highballs or 4 cocktails	The concentration will fall to 0.05 per cent in 5 to 6 hours.
5 highballs or 5 cocktails	The concentration will fall to 0.05 per cent in 8 hours.

* If taken within 2 hours after a full meal, approximately double these amounts.

TABLE I

According to studies made by the Northwestern University Traffic Institute, a driver with as much as a 0.15 per cent concentration of alcohol in his blood is 33 times as likely to have an accident as a man who has not had a drink.

3. *Carbon Monoxide Poisoning*

Driving along a rural highway, a man suddenly heard a crash, felt a bump, put his hand to his head, and felt moisture. He looked at his hand and saw blood. He looked about him and discovered, to his confusion, that he was sitting in his car in the middle of a creek. How he got there he never knew. The doctor's examination proved that his blood was poisoned by carbon monoxide.

A family was awakened on a winter night by the blowing of a horn. Their seventeen year old son was found sitting in the car in the garage slumped over the steering wheel. He had driven in and kept the engine running while he sat reviewing the events of the evening. Lapsing into unconsciousness, his body fell on the horn button, and the horn brought the puzzled family to the garage. Artificial respiration saved his life. Few cases of carbon monoxide poisoning end so fortunately.

"The continuous sound of the horn . . . saved his life."
FIG. 42.

Carbon monoxide is found in the exhaust gases of all automobiles and is produced by the incomplete combustion of gasoline. Excessive amounts come from poor ignition and faulty carburetor adjustment. The gas is colorless, tasteless, odorless, and can be deadly even in small amounts.

A motor running at idling speed, in a closed, private garage, can generate enough of this gas in a few minutes to overcome a person and cause death. In amounts too slight to cause headache, drowsiness, dizziness, or nausea, it can cause poor judgment and unsafe driving.

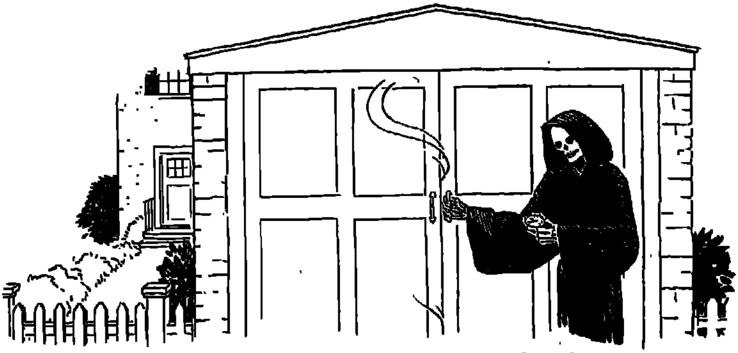

FIG. 48. Death stalks at the closed garage door when the engine is running. In a few minutes enough deadly gas is produced to bring on unconsciousness and death.

Follow these simple rules to prevent carbon monoxide poisoning:

1. Run your engine as little as possible inside a garage and then only with the doors open.
2. See that there is always plenty of fresh air in your car while driving. Children sleeping on the rear seat of closed or poorly ventilated cars have been asphyxiated.
3. Have a periodical inspection made of the entire exhaust system, the car floor, the heater system, and the "seal" between the body of the car and the engine, to discover carbon monoxide leaks.
4. Never run the engine to keep warm while the car is standing still, especially in a snow bank. The snow around the car may "pocket" the gas and cause it to seep into the body of the car.

If an odor of burned gas is noticeable in your car, open the ventilators immediately and force out the dead gas which carries with it the odorless carbon monoxide.

The first thing to do with a carbon monoxide victim is to get him into FRESH AIR. Send for a doctor. In the meantime, apply artificial respiration.

4. Worry

Driving requires constant alertness, and alertness is improbable with a distracted, preoccupied mind. Home trouble, worries, serious illness in the family and personal fears reduce the efficiency of a driver and make him more prone to accident. It is altogether probable that the frequent "crack-ups" of criminals who attempt an automobile get-away are caused, not only by high speeds, but by the desperate condition of the driver's mind.

Worry and fast driving do not safely mix. When worried, nervous, or depressed, let someone else do the driving.

DISCUSSION TOPICS

1. Discuss the meaning of "compensate" as it is used in this chapter.
2. How can a deaf person check his horn?
3. Might it be desirable to require drivers who reach their 60th birthday to pass periodical physical examinations and driving tests before renewal of their operator's license?
4. Can you cite instances of cripples who, because of compensation. drive as well as uncrippled persons? Explain how they compensate.
5. What is the policy of your state about refusing licenses to people with disabilities?
6. "Disqualify" is a strong word. Discuss the fitness of its use here, after reading through the four sections on Fatigue, Influence of an Intoxicant, Carbon Monoxide Poisoning, and Worry.

PROJECTS

1. By means of an audiometer, test the auditory acuity of each ear of the members of your group.
2. Using a dynamometer, test the grip of each hand of the different members of your class. Note the wide variation in strength in different persons and in the two hands of the same person. What relation has this to driving?
3. Interview 25 drivers and report on the means they use to ward off fatigue. Can all of them be recommended for common use? Which ones can be?
4. Construct and exhibit posters or cartoons on the subject of physical fitness and the driver.

5. *Motor Truck Facts* gives the regulations of all states concerning the time companies are permitted to allow drivers behind the wheel. The Bureau of Motor Carriers of the Interstate Commerce Commission has also set up similar regulations. Study these carefully. Summarize them, and then determine a set of regulations which you think your state should adopt. Report to the group for discussion, making sure you can defend your proposal.
6. Have the chemistry instructor demonstrate how the addition of alcohol changes the color of a solution of sulphuric acid and potassium permanganate, as in the breath test for intoxication.

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CHAPTER V

Reaction Time and the Driver

Do You Know:

How fast you can move?
How fast you can stop your car?
What conditions change your stopping time?

HOW FAST CAN YOU MOVE?

IT TAKES time to move. Even the quickest move you can make requires time. By means of a simple apparatus, the time required to make your quickest move can be accurately measured.

How long do you suppose it would take you to press your finger down on a telegraph key at the signal of a flash of light? Your finger is just above and touching the key; you know what the signal is to be; you sit watching for it to appear—ready to react. If you believe that you can make this movement or reaction in a time too short to be measured, you are mistaken. No one can, for a sensitively adjusted apparatus can measure your reaction in thousandths of a second.

Most reaction-time tests are built so that the same switch that turns on a red light or other signal also starts an electric clock. This clock is graduated to read in hundredths of a second. When you see the light, you press down "instantly" on the key, and the clock stops. The time the clock was running between the flashing of the light and your pressing on the key may be read from the dial. This is a measure of the time it took you to make the movement. It is your *simple reaction time.*

In the above experiment your brain and your hand muscles had to work together. An impulse—something like electricity—

had to pass along the nerve paths from the eye to the brain and then to the muscles in your hand. This is what took time.

MEASURING A DRIVER'S REACTION TIME

Reaction time is important in driving. The time needed to stop a moving car is not merely the time during which the brakes act. It takes time for the driver to get his foot on the brake after he has seen the need of stopping. This is called the driver's *braking reaction time.*

If a driver is all set to react, knows what signal to expect, and has no choice as to what reaction he will make, then the time required is his simple reaction time.

Several devices have been developed for testing simple reaction time. The one shown in Fig. 44 is relatively easy to make. This test measures how long it takes the driver, after seeing a red light, to move his right foot from the accelerator pedal to the brake pedal.

FIG. 44. Reaction-time testing device for measuring the time required to move your foot from the accelerator to the brake pedal. How fast can you move?

Clutch, brake, and accelerator pedals are arranged on the device as they are in an ordinary automobile. Red and green lights are mounted in a small box above the test. When being tested you sit down and place your right foot on the accelerator. Pressure on the accelerator closes a circuit which turns on the green light and starts a small motor. This motor, in turn, starts a timer hand traveling around a dial that is built into the side of the test. As the timer hand passes "0" on the dial, the red light flashes on. When you see the red light, you step on the brake pedal as quickly as possible. This stops the timer hand,

and so the distance the hand travels beyond the "0" gives a measure of the time you required to react to the red light.

If you "jump the gun," that is, remove your foot from the accelerator before the red light comes on, the green light will go out and the operator of the test will disregard the trial.

After a few practice trials, at least ten real trials should be given and the average used. Because people vary so much from trial to trial, the average of only two or three trials is not an accurate measure of a person's true reaction time. In highly scientific laboratory work perhaps 40 to 50 trials would be used.

Reaction time varies with the type of test used and the way it is given. For the test just described, the average reaction time is about 0.40 second. Some people are much slower to react than this.

MEASURING COMPLEX REACTION TIME

The test just described presents a very simple situation in which you know what to expect and exactly what to do. When the red light comes on, you make just one movement.

Under actual driving conditions your reactions are not so simple. In the first place, you are not always watching for a signal to stop. Several events or signals, each requiring a different reaction, may occur almost at once. You may have to make a left turn to avoid hitting an obstacle, give a hand signal, and slow down, all at one time. Or you may have to choose between courses of action—for example, whether to brake hard or spurt ahead out of trouble. Because your attention is focused on several things and more and higher brain centers are involved, your so-called *complex reaction time* is longer than your simple reaction time.

One device for measuring complex reaction time consists of a right-turn arrow, left-turn arrow, red light, and steering wheel, in addition to the usual pedals. The red light and arrows are turned on automatically at random intervals. As each signal comes on, the driver is required to make the proper

FIG. 45. Device for measuring your complex reaction time, when you must make different reactions depending upon unexpected circumstances.

response by turning the steering wheel or stepping on the brake pedal. An electric timer records the time. On this particular test, the average complex reaction time is about 0.60 second.

An actual driving situation is still more complicated than this test situation. It constantly requires unexpected choices. The judgments you must make require time. Under actual driving conditions, the average reaction time is likely to be around 0.75 second.

The average driver's reaction time is, then, actually a split second! But it is by no means an insignificant split second. Do you know what your car can do in three quarters of a second?

THE IMPORTANCE OF REACTION TIME IN DRIVING

Suppose that you are an average driver with a reaction time of about 0.75 second. In what distance can you make an emergency stop?

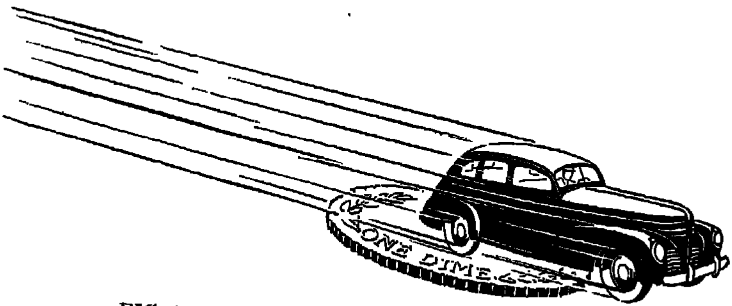

FIG. 46. Stopping "on a dime" just can't de done.

An interesting device called a Brake Reaction Detonator has been developed to measure this distance while you actually drive your car. (See Fig. 47). Let's see how this device can be used to test your reaction time.

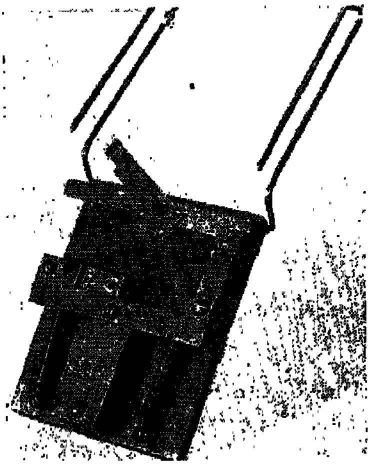

FIG. 47. This Brake Reaction Detonator can be used for measuring your reaction time distance and braking distance while driving your own car.

The Detonator is hung on the front bumper. Two .22 blank cartridges are then inserted in the tops of two miniature gun barrels, and pieces of ordinary chalk are placed in the ends of the barrels pointed toward the street. The person who is testing you sits beside you in the front seat and tells you to drive at a given speed, such as 20 miles per hour, and to stop as quickly as possible when you hear a shot fired. After some distance and unknown to you, he pulls a string to fire the first shell in the Detonator.

This explosion forces the piece of chalk down on the pavement, marking the exact spot where you were warned to step on the brake. In a split second, your foot hits the brake pedal, and at this moment the jerk of the car automatically fires the second shell in the Detonator, making another chalk mark on the pavement. This last mark indicates the location of the front bumper when you got your foot on the brake. You can now measure the distance between the two chalk marks on the pavement and you will have your *reaction time distance.*

If you are an average driver with a reaction time of three-fourths of a second (0.75 second), and if you are traveling at 20 miles per hour, the distance between the two marks will be 22 feet. In these 22 feet, you have not even slowed down

the car. It has taken you this full 22 feet merely to move your foot off the accelerator pedal and put it on the brake pedal.

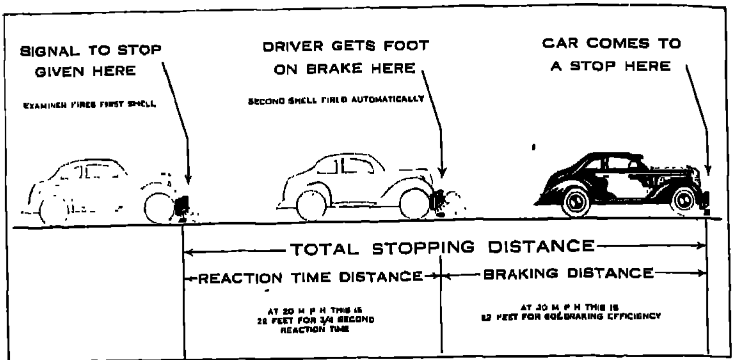

FIG. 48. Testing reaction time distance with the Brake Reaction Detonator.

At higher speeds this reaction time distance increases greatly. For example, at 60 miles per hour, the distance is 66 feet—four full car lengths. (See Fig. 49.) The distance travelled while reacting to a danger signal varies directly as the speed.

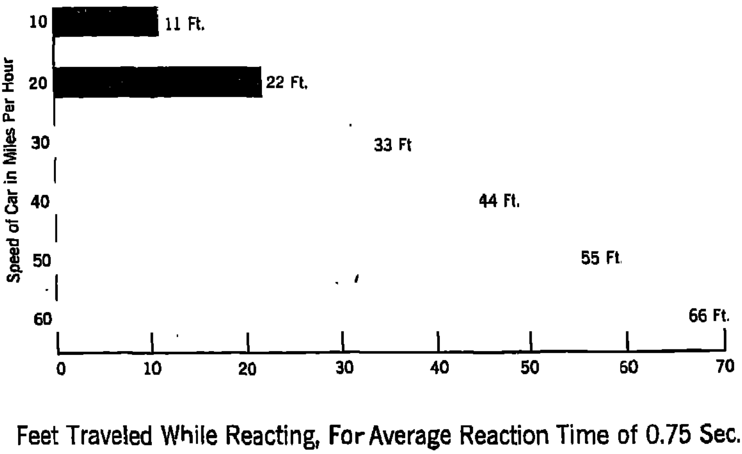

FIG. 49. Reaction time distance in feet for a person with an average reaction time of 0.75 second driving at different speeds.

Suppose you are driving on the open road at 40 miles per hour. Just as you begin to pass a line of three cars parked bumper to bumper along the roadside, a child darts out from the front of the third car. Even if you see him at once, you will have travelled 44 feet, or nearly the total length of three parked cars, and be upon him by the time your foot has just begun to press the brake. Even in split-second reaction, your car covers this astonishing distance.

The distances in Fig. 49 are all for the average driver. Many drivers, however, are much slower than the average. Some require even 1.5 seconds, or twice the average to react. At 40 miles per hour, these slower people would travel a reaction time distance of 88 feet instead of 44 feet.

BRAKING DISTANCE MUST BE CONSIDERED

When a car is brought to an emergency stop, not only the reaction time distance must be considered but also the braking distance. After the foot finally reaches the brake pedal, additional distance is covered before the brakes stop the car. This braking distance is dependent upon three important factors:

A. The speed of the car
B. The "grip" of the brakes on the brake drums or wheels
C. The "grip" of the tires on the road surface

Speed is a more important factor than is generally realized. If your brakes are just fair and will stop your car in 30 feet at 20 miles per hour, how far will your car go at 40 miles per hour before the brakes will bring it to a stop? Here, again, many people underestimate the distance. They believe that, if the speed is doubled, the braking distance will be doubled. But *braking distances increase as the square of the speed.* So, actually if your speed is 2 times as great, or 40 miles per hour, your braking distance will be four times ($2 \times 2 = 4$) as great, or 120 feet. If your speed is 3 times as great, or 60 miles per hour, your braking distance will be nine times ($3 \times 3 = 9$) as great, or 270 feet. (See Fig. 50.) This is one of the reasons for the bad accident records of vehicles driven at high speeds.

especially when brakes are in poor condition or the road is slippery.

Many states now require, as a minimum standard, that four-wheel brakes be good enough to stop a car going 20 miles per hour in 30 feet. This is a braking efficiency of 44.5 per cent.

The tendency of people to underestimate braking distance is very common. In one survey of 9,000 drivers, two drivers out of three said they could stop their car in 15 feet or less at 20 miles per hour. Actually, such a distance is an impossibility, regardless of how good the road surface or the brakes may be.

In 1943, the Public Roads Administration conducted a survey of 898 passenger cars with four-wheel brakes and found that the median braking distance at 20 miles per hour was 27 feet. Thirty-six per cent of the brakes failed to come up to the minimum standard of stopping a car in 30 feet at 20 miles per hour.

In addition to speed of car and condition of brakes, the "grip" of the tires on the road surface helps determine the braking distance. If the tires are smooth or improperly in-

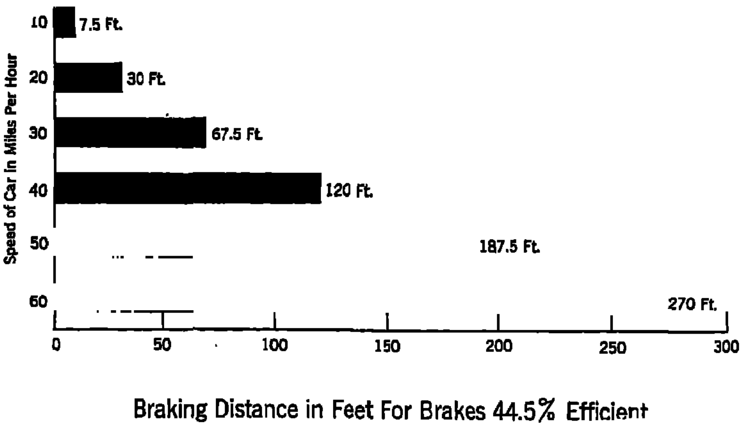

FIG. 50. Braking distances increase as the square of the speed. At 40 m.p.h. the distance is 4 times as great as at 20 m.p.h. At 60 m.p.h. it is increased 9 times!

flated and if the pavement is icy, wet or otherwise slippery, additional length is added to the already surprisingly long braking distance.

THE TOTAL STOPPING DISTANCE

We now must bring the data from Fig. 49 and Fig. 50 together to get the total distance required to stop after a danger has been sighted. These total distances are shown in Table

STOPPING DISTANCES

This table is for an average reaction time of 0.75 second and brakes that just meet the requirements of the Uniform Vehicle Code (44.5% efficient). (Public Roads Administration found that average passenger car brakes were about 48% efficient.)

IF YOU GO THIS FAST:		After seeing the danger you will go this far before you are able to step on the brake:	After you apply your brakes you will go this much farther before your car stops:	You will travel this total distance from the time you first see the danger until your car stops:
Miles Per Hour	Equivalent Feet Per Second	REACTION-TIME DISTANCE (feet)	BRAKING DISTANCE (feet)	TOTAL STOPPING DISTANCE (feet)
10	14.7	11.0	7.5	18.5
15	22.0	16.5	16.9	33.4
20	29.3	22.0	30.0	52.0
25	36.7	27.5	46.9	74.4
30	44.0	33.0	67.5	100.5
35	51.3	38.5	91.9	130.4
40	58.7	44.0	120.0	164.0
45	66.0	49.5	151.9	201.4
50	73.3	55.0	187.5	242.5
55	80.7	60.5	226.9	287.4
60	88.0	66.0	270.0	336.0

TABLE II

II for a driver with average reaction time and a car with near average brakes.

There is nothing you can do to *eliminate* either the reaction time distance or the braking distance. You can, however, do much to reduce these distances.

The first factor, reaction time distance, depends on the way a human being is put together. In ordinary driving situations, you can help keep it down by being always alert for traffic dangers, by becoming very familiar with the car, and by establishing good driving habits. By paying close attention to traffic, you recognize dangers sooner. By being familiar with the car and good driving practices, your reactions become partially automatic. You don't have to "stop and think" before making the proper reaction.

The second factor, or braking distance, can be decreased only by replacing worn brakes and by keeping the brakes in perfect adjustment and the tires in good condition. It cannot be eliminated because it depends on certain mechanical factors. Brakes have been greatly improved by skilful engineering. But there comes a point beyond which their speed in stopping a mighty force like a rapidly moving car cannot go. Passengers would not be tolerably comfortable, or even safe.

It would be a good thing if every driver could take a reaction time test. He would know how his normal reaction time compares with the average. He could then keep his reaction time in mind when determining what speeds he could safely use. Professional drivers, with no-accident records, know the limitations set upon them by their own reaction times and upon their brakes by mechanical factors. They keep their enviable records by driving accordingly.

THE DANGER ZONE

The stopping distance represents a danger zone which always stretches out ahead of every moving car. It is the distance within which you cannot stop.

As the reaction time of the driver increases, the danger zone lengthens. As the speed of the car increases, this zone

of danger stretches out very much farther. Road conditions and brake conditions can make it still longer.

The driver always has this danger zone to deal with. You cannot escape it. In your driving, you must always plan for

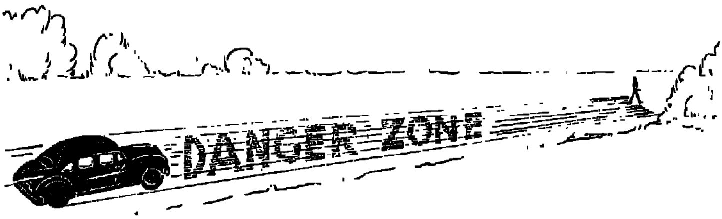

FIG. 51. Always in front of you is your "danger zone"—as though it were a part, an extension, of your car.

it. Your car cannot really be in control unless you are taking this danger zone into consideration.

You help decide the length of the danger zone ahead of your own car by:

The way you care for or neglect your brakes and tires.
The condition in which you keep your own body.
The amount of pressure on your accelerator.

The danger zone should NEVER be allowed to become greater than that distance ahead which you are SURE is clear of hazard.

IS YOUR REACTION TIME ALWAYS THE SAME?

We have been talking about the *average* reaction time. But each person must consider his own.

Even when you are in a normal condition, your reaction time may change considerably. Some people have a more consistent reaction time than others, and are less likely to be involved in collisions. If you find out, by test, that your own reaction time is likely to vary considerably from day to day, be guided by your longest reaction time in estimating your stopping distances.

The physical condition of the body varies from day to day, and reaction time changes with physical condition. This can be shown by actual measurement. Laboratory tests have proved that reaction time is measurably increased by:

1. Fatigue
2. Age
3. Alcohol
4. Distractions, such as—day-dreaming, worry, or sorrow, business or social planning, conversations, radio
5. Carbon monoxide
6. Eye strain
7. Low visibility
8. Sedative drugs

In the case of alcohol, subjects in experiments reported by the Laboratory of Applied Physiology of Yale University were found to have slowed down in visual reaction time according to the following table:

The Effect of Alcohol on Visual Reaction Time

Alcohol Equivalent to Glasses of Whisky	Per cent Slowing of Visual Reaction Time 1 Hour After Drinking
1½	6
2½	12
3½	34

TABLE III

In driving, a 34% reduction in visual reaction time would mean that, traveling at 50 miles per hour, it would take about 17 feet more road space to bring the car to a full stop after a visual signal to do so. This is a powerful argument against the use of alcohol by drivers.

The Council on Pharmacy and Chemistry of the American Medical Association agrees that certain drugs, such as bar-

bital, veronal, phenobarbital, and luminal, are being too freely used by the general public, and that these drugs have a dulling effect on reaction time and mental processes. A driver does well not to use such drugs without medical advice.

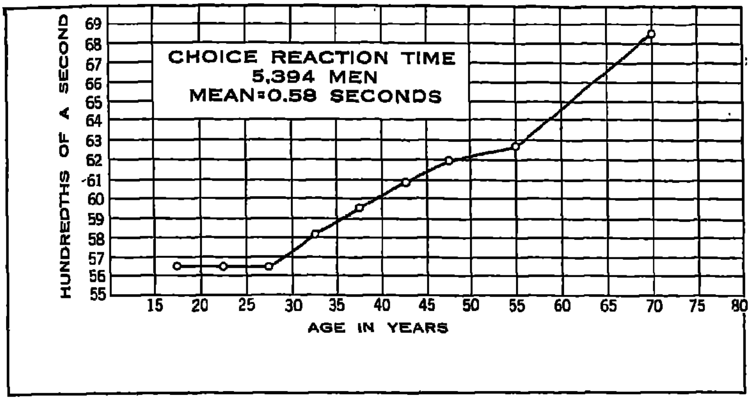

FIG. 52. Young drivers generally have a good brake-reaction time, according to an analysis of 5,394 tests of choice reaction time made by the American Automobile Association.

MARGIN OF SAFETY

Realize your limitations in stopping a car, and provide safe margins of space when driving:

Behind other cars
In built-up sections
With unfavorable road conditions
In a strange car
Near intersections
At night
When under par physically or mentally
On unfamiliar roads
Where there are pedestrians

With professional drivers, it is a matter of pride to be familiar with these technical points in driving and to act accordingly.

Dangers loom up instantaneously. But stopping a car can never be an instantaneous matter. The driver alone can provide the *margin of safety* which can prevent sudden danger from ending in catastrophe. Expert drivers provide just such a margin.

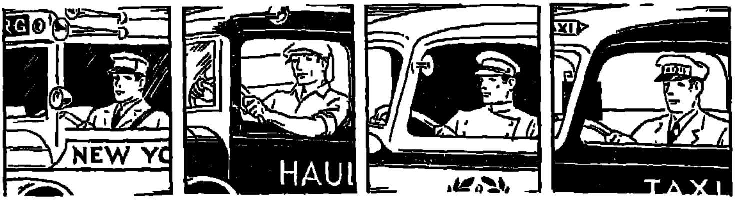

FIG. 53. The best professional drivers always provide margins for safety.

DISCUSSION TOPICS

1. Discuss the ways in which a driver can improve his reaction time.
2. Discuss the factors which affect the braking distance of a car.
3. Describe the circumstances where an accident is certain because of the reaction time and braking distances involved.
4. Show that the "danger zone" is a flexible thing and that the driver controls the length of it almost as he would a rubber band stretched between two fingers.
5. How do you account for the fact that reaction times differ:
   (a) in different individuals?
   (b) in the same person at different times?
6. Why is it almost impossible to determine your true reaction time under general driving conditions.
7. To what extent is the "braking distance" at any particular speed dependent upon the driver?

SPECIAL PROJECTS

1. Secure "Plans for Building Driver Tests" and build the foot reaction test.
2. Let the members of the study group join hands to form a "chain." Let a leader in the chain press the hand of the person next to him. Let each one relay the "squeeze" to his neighbor as soon as he receives it. With a stop watch, or the second hand of an ordinary watch, measure the time it takes the "squeeze" to travel around the chain. Divide the time in seconds by the number of people in the chain to find the average "touch" reaction time per person.

3. Secure a Brake Reaction Detonator and make stopping distance tests at 20 and 30 miles per hour.
4. Measure the distances shown in Fig. 49 along a curb so that the average reaction time distances will be clear in your mind.
5. Measure off the distances shown in Fig. 50 so that these braking distances will be clear in your mind.
6. Make a table showing the reaction time distance at 20, 40, and 60 miles per hour for: (a) a slow driver with a reaction time of 0.90 second; (b) a very slow driver with a reaction time of 1.2 seconds.
7. With the aid of Table II, determine how far a driver will go after he first perceives danger until he brings his car to a stop at 30 miles per hour, if his reaction time is average (0.75 second) and his brakes only half as good as indicated in the table. Illustrate distance by drawing cars in 20-foot parking stalls.
8. Copy this chart. Use a scale of one inch for every fifty feet of roadway. Measure off, on the copy you have drawn, the danger zone ahead of the cars which are being driven at different speeds by a driver with average (or better, *your own*) reaction time. Color the danger zones red.

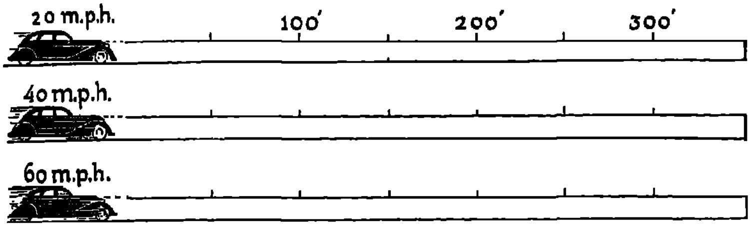

FIG. 54.

9. If an average parking space of 20 feet is being used by each car, show how many parked cars the driver will have to pass from the time he perceives danger ahead until he could bring his car to a complete stop if his reaction time is 1 second and his car is moving at the rate of 40 miles per hour.
10. Measure off distances 52.0, 100.5, 164.0, 242.5, and 336.0 feet along the curb so that each distance in Table II will be clear in your mind. Mark off the above distances from the same starting point. Sit in a car at this starting point and study the marked distances in relation to the car speed associated with it in Table II. Try to fix these distances well in mind so that you will have a good idea how far your car will go before you can stop it from various speeds.

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CHAPTER VI

Good Traffic Habits

Do You Know:

How habits are formed?

Correct habits for the driver? The pedestrian? The bicyclist?

How sound habits help in emergencies?

HABITS AS SERVANTS

A SHINY new automobile dashed down the avenue, horn blowing loudly and brakes screeching as they were suddenly applied at every street intersection. It was almost school time, and a father was trying desperately to save his son from being late to school.

The boy sized up the situation. "Father," he said, "I think you'd better not drive so fast."

"I have to drive fast," his father answered, pressing harder on the accelerator. "Don't you want to get to school on time?"

FIG. 55. ". . . but I'd rather be late than absent."

The boy shook his head seriously. "Sure, Dad, I'd like to get to school on time," he said, "but I'd rather be late than absent."

Good personal habits, like that of starting on time, have a lot to do with your personal contribution to the general safety of the traffic picture.

Good habits are the servants of man.

This is because good habits free man's mind from the thousand and one details of daily life. If, for instance you had to stop to think out every move you make in getting ready to start on a trip, you would probably not start at all. You would be in the predicament of the famous centipede who managed his hundred legs with expert and unconscious skill until a curious fellow worm inquired how he did it. This question threw him into such confusion that, according to the verse, he

"... lay prostrate in the ditch,
Not knowing which leg
Came after which!"

Good habits make you efficient. They free your attention for other matters. They are foundations for skill and dependability. They help build up expertness.

HABITS IN THE MAKING

Habits are learned. They come about by repetition. When you do things over and over, you form habits without much thinking.

Every time you do a thing, it becomes easier to do it again. Certain pathways in the nervous system are made stronger. Your habitual acts become firmly built into your nervous system. They grow to be a part of you.

When you want to learn a new skill, you must form new habits. First analyze the new skill and find out exactly what new habits you need. That helps shorten your learning time and also improves the quality of your skill.

Your driving skill will be made up of the acts you practice from the beginning. So practice only correct acts. Learn exactly what driving habits are correct, and then go about forming them. Practice those particular acts *every time* you have an opportunity. Your driving habits will then be prac-

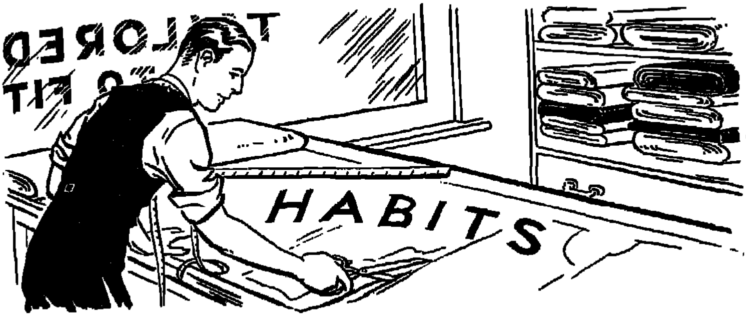


FIG. 56. A driver can custom-build his habits.

tically *custom-built*. You chose to build them because they fit good driving needs.

In the process of establishing certain acts in your system of habits, there are two very good rules that it pays to follow:

Practice exactly as you want to perform.
Never permit exceptions to occur.

Do you remember poor old Rip Van Winkle who decided to form a new habit of *not* getting drunk? He used to get so thirsty that he'd waken and take another drink, saying he'd "not count this one." Well, whether Rip counted this one or not, it *counted deep down in his nervous system* where habits are made.

If you follow the rules and practice correct acts without exceptions, the time will come when you do correct things automatically, without effort or thought. You then have a set of reliable driving habits. That is the first step on the road to driving expertness.

How Road Practice Fits In

In learning any complex performance such as driving, habits are built one on the other. Simple acts, firmly established, are the foundation for complex habits. Hurrying carelessly over the first, simple steps in acquiring skills, is very much like building a cheap, flimsy foundation wall. There is a weak substructure. And sound building, whether of habits or of

houses, is not accomplished on weak substructures. *Master each step before moving on to the next.*

Now you can see why the supervised road practice part of driver training is so important. In supervised road practice, you start with correct foundation acts and learn them by actually doing them. A program of thorough road practice, under a teacher who knows sound driving habits, is your best possible assurance of a good habit background for driving.

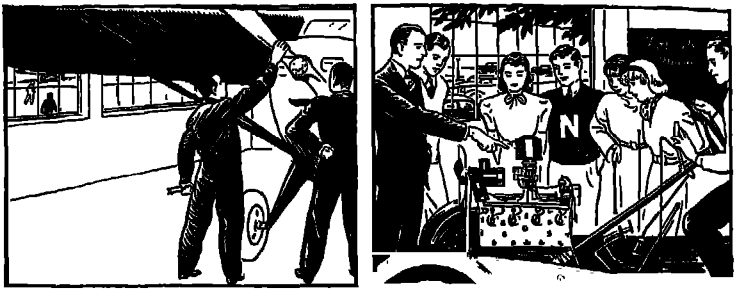


FIG. 57. "Ground training," essential in learning to fly, is also important in learning to drive a car.

The applicant for an air pilot's license has to have a certain number of hours in the air to his credit. These hours in the air and at the controls are not for the purpose of teaching him how to fly a plane. He could learn that, in a relatively short time, on the ground. They are for the purpose of establishing reliable flying *habits*. In the same way, only hours behind the wheel of a car can give the automobile driver the proper set of correct habits.

GOOD DRIVING HABITS

You can classify driving habits in two groups:

A. Habits Needed for Simple Mechanical Operations
B. Habits Needed for the More Complex Maneuvers

Consider each group separately.

A. Habits Needed for Simple Mechanical Operations

In this group you find:

1. Starting the engine
2. Shifting gears
3. Using the accelerator
4. Using the clutch
5. Steering
6. Braking

Such habits involve muscular adjustments. After repeated practice, you make these movements automatically or without thought. They become firmly built into your nervous system. They become fixed patterns in your behavior.

Human beings are made in such a way that the things they do over and over again will, in time, leave an indelible trace. In all probability, you will always do these simple, mechanical operations as you first learn to do them. But some ways of starting an engine, shifting gears, using the clutch, steering, and braking are better than others. Supervised road practice is the answer.

B. Habits Needed for the More Complex Maneuvers

Too many habits to name belong in this group. There are habits of thinking and acting that make some drivers consis-

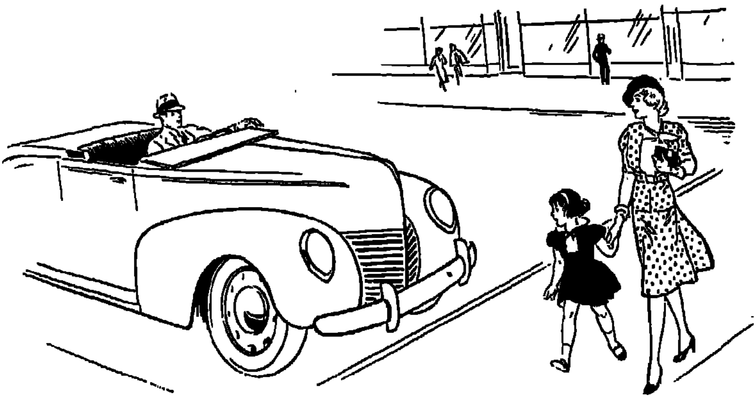


FIG. 58. He courteously stopped back of the crosswalk. Is courtesy a common driving habit?

tently more sportsmanlike than others. Some drivers are consistently superior in the whole management of their cars in traffic. The reason lies largely in their *habitual attitudes.* Good attitudes of responsibility give them good driving personalities.

Superior quality shows in the driving behavior patterns of persons who have established *habits* of:

1. Observing traffic laws, traffic signals, and road signs
2. Constantly sizing up traffic situations as far ahead as possible
3. Signaling intentions correctly
4. Making correct use of the rear-vision mirror
5. Regularly inspecting the car's safety equipment
6. Slowing down at potential danger points
7. Keeping in the correct lane of traffic
8. Making proper use of the horn
9. Starting ON TIME to meet appointments
10. NEVER TAKING A CHANCE
11. Controlling driving speed to meet conditions
12. KEEPING ALCOHOL OUT OF THEIR DRIVING

In Chapters XVII and XVIII on sound driving practices in rural and city driving, we shall discuss such habits in detail and see what they look like when broken down into specific acts.

Habits in Exceptional Circumstances

Sound habits help forestall emergencies. The driver who has taken the trouble to equip himself with the habits already mentioned under groups A and B is not likely to have to face many emergencies. The more drivers with good habits, the fewer the emergencies.

An emergency always presents elements of newness. It can seldom be met completely on a habit basis. But any sound habits of good driving serve to reduce the possibility of your doing the wrong thing and complicating the emergency. All the habits needed for "Simple Mechanical Operations" or for the "More Complex Maneuvers" are serviceable in an emergency.

There is one habit, however, that can rightly be called an "emergency preventive." It is the habit of Attention to:

1. The car
2. The road
3. The immediate traffic conditions
4. Pedestrians

Driving is a thing that cannot be done with inattention and nonchalance. The tennis player returns the unexpected bounce because he is "on his toes." The football player profits by the opposition's fumble because he is "on edge" in the situation. Each has met an emergency. He would have failed to meet it if he had not been in a state of *readiness-to-act*.

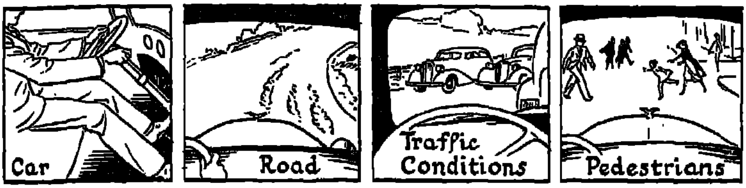


FIG. 59. Constant attention to these four factors helps in avoiding emergencies.

Readiness-to-act follows close attention. With the *habit* of attention, you are not caught unprepared. For the athlete, it wins the game. For the automobile driver, it saves life.

Driving a New or Strange Car

People who drive new or strange cars for the first time are likely to say that they do not feel at home. This means that certain old habits are being interfered with.

Driving habits are built around the mechanical set-up of your own car. This is especially true of habits needed for simple mechanical operations—where motor skill is involved. This is because your muscles have learned just what degrees of *force*, *direction*, and *time* are required to reach certain levers and appliances and properly manipulate them. With a new and strange set-up, the same *force*, *direction* and *time* may produce unexpected and dangerous results.

Errors creep into the work of even an expert typist with an unfamiliar machine. Even with a standardized keyboard, the new action of the machine requires new habits of timing. New models and different makes of automobiles are likely to be even more disorganizing to habits, for they seldom have a standardized arrangement of appliances.

The concert pianist takes his own piano along with him, or insists on practicing on the strange one in order to adapt his habits to the new instrument before his public performance. An automobile driver is *always* giving a public performance.

Extra care is required to drive a strange car. Old habits may actually work against the driver. Old habits may have to be reorganized. This reorganization can take place in a relatively short time. But over a longer time there is danger that the new habits may break down in emergencies.

THE HABITS OF GOOD PEDESTRIANS

Sportsmanlike driving should be matched by sportsmanlike walking on the part of the pedestrian.

Pedestrians need a few thoroughly formed habits. This is true both on city streets and on rural highways. Many pedestrians are responsible for their own destruction. Many of them have not formed proper habits of *where, when* and *how* to walk. They are "jay-walkers" because they lack sound pedestrian habits. No "jay-walker" ever has the right-of-way.

City Pedestrians

Three city pedestrian habits have major weight. They are so basic to pedestrian safety that they should be followed without exception:

1. Obey traffic signals as rigidly as drivers must obey them.
2. Cross streets *only* at intersections.
3. Always look carefully in all directions.

Habits such as these should be built into pedestrians while they are still children. Schools, churches, homes, motor clubs, and police forces are carrying out effective instruction and safe-walking campaigns in many places to give pedestrians

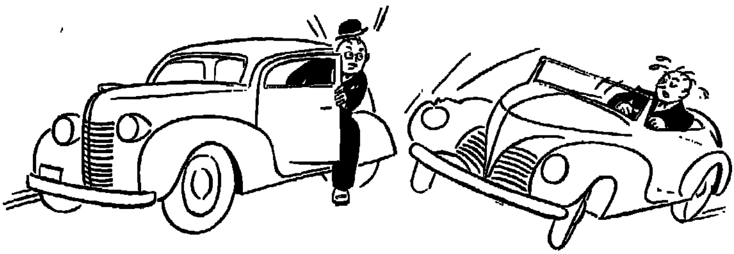


FIG. 60. Stepping out on the street side is stepping into danger!

proper habits while they are young. This is the time good habits should be formed.

If a pedestrian forms these three basic habits, other good pedestrian habits form in consequence, and he does not do the stupid, dangerous things that make a person a traffic nuisance. He waits on sidewalks, rather than in the street, for traffic changes. He never steps into the street from behind parked cars or darts unexpectedly into the street without looking. And he never weaves in and out through traffic, zigzagging absurdly from one clear spot to another like Eliza skipping across the river on floes of ice!

When you are in traffic as a pedestrian, take special care to follow the three major pedestrian habits at certain exceptional times, such as when:

It is dark, raining, or snowing
You are in a hurry

FIG. 61. What's wrong with this chap?

You are carrying an umbrella or large bundles
The streets are slippery
Crowds are dispersing
You are not well
You are worried or distracted

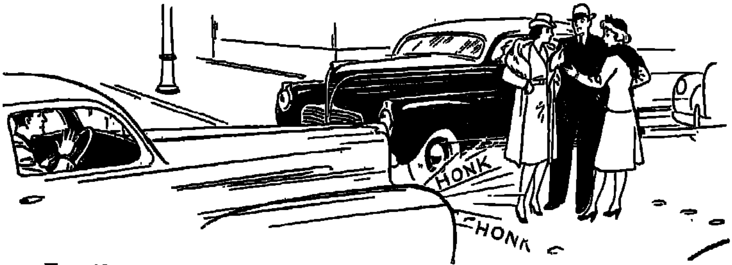


Fig. 62. People who stand in the street chatting with friends belong to the horse-and-buggy days.

Using Street Cars and Buses

Pedestrians need good habits in waiting for street cars and buses and in alighting from them. Especially good ones are:

Wait on safety zones, where they are supplied.

Where there are no adequate safety zones, wait on sidewalks.

Where you must wait in unprotected zones, face oncoming traffic.

Never cross behind or in front of public vehicles from which you have stepped.

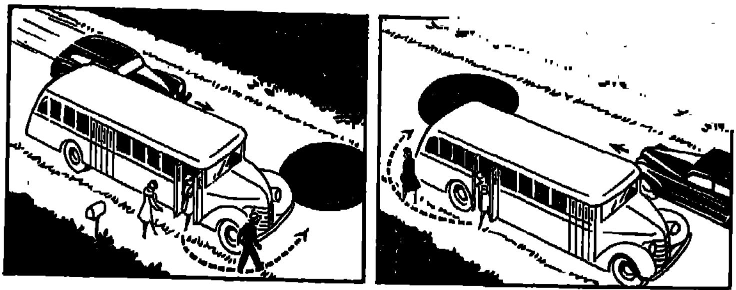


Fig. 63. Wait until your bus or street car moves on. The black circles indicate danger spots.

Walking Habits on Rural Highways

Four habits stand out as good ones for pedestrians on rural highways:

1. Use highway sidewalks, where they are provided.
2. Walk on the *left* side of the highway, facing oncoming cars.
3. Step off the road when nearby cars are going to pass each other.
4. Wear or carry something white at night.

FIG. 64. Why is there "double safeguarding" when you walk on the left of the highway?

The habit of walking on the left is even more important at night than in the daytime. The pedestrian can see the headlights of an approaching car and safeguard himself long before the driver can see him.

The habit of wearing something white at night, or of carrying a light or suitable reflector, greatly increases the distance at which a night pedestrian can be seen.

Accidental walking habits are not good enough for the man on foot in the complicated traffic of this motor age. Like the driver, he needs "custom-built" habits, well-designed to fit his needs.

BICYCLING HABITS

The bicyclist is neither a pedestrian nor a motorist, but he is subject to traffic regulations. There are certain special habits which he needs to develop. With bicycling enjoying great popularity, what the bicvclist does in traffic is verv important.

The bicyclist should learn, AWAY FROM TRAFFIC, to ride a bicycle steadily, without wavering about, and to start, steer, signal, stop, and turn skilfully. Such basic bicycling practices should be made *habits* before the bicyclist ever ventures into fast or heavy traffic. From the moment the bicyclist begins to learn to ride, he should build the following practices into habits:

1. Be on the alert for motor traffic, especially when entering the street from alleys or private drives.
2. Keep to the extreme right of the roadway, except when passing or turning left.
3. Drive in single file—never abreast of another bicycle rider.
4. Never carry two persons on a bicycle built for one.
5. Drive with both hands on the handlebars, except when signaling.
6. Never hitch on to vehicles.
7. Keep the bicycle in good condition—especially its lights, brakes, and steering mechanism.
8. Always have a white headlight and a red tail-light or a good red reflector showing at night.
9. Never weave in and out of traffic.
10. Obey all traffic signals.
11. Signal for all turns and stops, using regular motorist arm signals.

Enforcement authorities find it increasingly necessary to give attention to bicyclists. New regulations are being enacted and enforced to require the bicyclist to fit properly into the traffic pattern. The bicyclist shares responsibility for orderly traffic. He can do his part by forming and practicing sound bicycling habits.

DISCUSSION TOPICS

1. If the things man does over and over again leave an indelible trace, is habit the servant of man, or is man the servant of habit? Could it work both ways? Illustrate.
2. Give specific examples of highway courtesy and discourtesy. To what extent would your observations of people make you believe that road courtesy and discourtesy are largely a matter of per-

sonal habit? What relation does this have, in your opinion, to good and poor personality?
3. As a group, discuss and extend the list of habits under B, page 84.
4. Recall specific driving emergencies you have experienced, witnessed, or heard about. How could they have been prevented by better driving habits? What part did good driving habits play in helping to meet them?
5. In terms of this chapter on habits, make and discuss a list of several characteristics of the superior driver.
6. Statistics show that, at urban intersections, 75 per cent of pedestrians involved in accidents are struck before they reach the center of the roadway. On the basis of this fact, what sound pedestrian habits should be formed?

SPECIAL PROJECTS

1. Make a list of ten specific driving habits which you think most important. Stand for an hour at a busy intersection and record observations of how drivers use or fail to use these habits. Discuss your observations with your group.
2. Prepare a tally sheet listing sound pedestrian habits. For one hour, check the practices of individual pedestrians at a busy corner used by numerous pedestrians, recording both good and bad habits observed. Discuss your observations with your group.
3. Examine the accident records at your traffic police headquarters. What light do they throw on the habits that drivers, pedestrians, and bicyclists should use?
4. Discuss this matter of habits and driving with some expert or experienced driver of your acquaintance. Ask him:
   a. How much of his driving is "automatic"?
   b. How long and how seriously do his old habits affect him in driving a new or strange car?
   c. What driving habits has he found most valuable? Ask him to discuss their value in connection with specific driving situations.
   d. Does the fact that he is so experienced or that he has a no-accident record make him feel that he must be especially cautious? Why? Where?
   e. How have habits helped him in emergencies?

FOR FURTHER READING

Pedestrian Protection. American Automobile Association, Washington, D. C. 1939. 90 pp.

Psychology. James, William. Henry Holt and Co., New York. 1910. Chapter X, "Habit." This interestingly written chapter is a classic on the subject of habit formation.

Why We Behave Like Human Beings. Dorsey, George A. Blue Ribbon Books, Inc., 386 Fourth Avenue, New York.

CHAPTER VII

The Psychology of the Driver

Do You Know:

Why drivers differ?
Why some drivers tend to have accidents?
Who are psychologically unfit to drive?
What mental qualities promise topnotch driving?

WHY DRIVERS DIFFER

NO TWO persons behave in exactly the same way. Man cannot be standardized as the car has been. He is not constructed of machine-made parts. The part that is strong in one person may be weak in another. Each person develops a special combination of abilities, habits, and attitudes, depending on such factors in his background as his:

Heredity
Environment
Training
Physical condition

FIG. 65. Your traffic behavior is determined by these factors.

Why the driver behaves as he does is a problem of driver psychology. We want especially to know how to avoid the mental twists, or psychological weak spots that produce the kind of driver behavior that results in highway accidents.

BEHIND THE SCENES IN THE DRIVER'S MIND

Can we get "behind the scenes" in the driver's mind and learn about his mental weak spots?

Engineers have managed to get "behind the scenes" in the

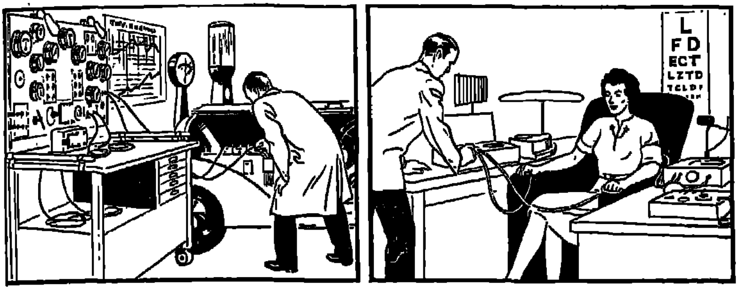


FIG. 66. Drivers as well as cars often require trouble-shooting.

car's makeup. When a car fails to perform as it should, technical experts analyze the situation, find what the car troubles are, and correct them. Can we do as well with the driver? Can we get "behind the scenes" and analyze him to discover what it is about him that causes trouble at the wheel?

To a considerable extent we can. The psychologist, the physician, the judge, the traffic engineer, and the traffic officer have been studying what it is in a person's make-up that gets him into traffic troubles. It is known that some drivers are much more likely than others to have accidents. We call such drivers "accident-prone."

Studies made by the U. S. Public Roads Administration, as well as by certain commercial concerns operating large fleets of cars, show that some drivers tend to be accident-repeaters. On a fleet of cars, for example, a small group of accident-prone drivers may prove responsible for most of the accidents.

Some of these drivers are accident-prone because they are psychologically unfit. They have wrong attitudes. Their wrong attitudes and their emotional weaknesses make them bad risks as drivers.

The ideal results of driver trouble-shooting would be to:

1. Sort out accident-prone drivers and deprive them of driving privileges.
2. Test drivers and prospective drivers for certain mental and emotional weaknesses in an attempt to "spot" accident-prone persons before they have accidents, or even before they begin to drive.
3. Show individuals how to recognize and correct accident-causing traits in their own psychological make-up.

What Happens
To The Accident Record When
ACCIDENT-PRONE DRIVERS
Are Weeded Out

YEAR	MILES TRAVELED	NUMBER OF ACCIDENTS
1st year	2,400,000	176
2nd year	2,680,000	173
3rd year	2,640,000	137
***4th Year**	**2,880,000**	**69**
5th year	2,394,000	55
6th year	2,373,000	45

* Accident-prone drivers were put on other work.
—From Highway Research Abstracts

TABLE IV

CERTAIN BAD RISKS AS DRIVERS

The Egotist

All babies are normally self-centered. They are good examples of the perfect egotist.

As you grow out of babyhood, you learn that self is really not the center of the universe. If you develop normally, you become more social, that is, your interests spread out and away from self, and you see things more and more in the light of public good. You acquire social attitudes.

With his normal psychological make-up, the baby would

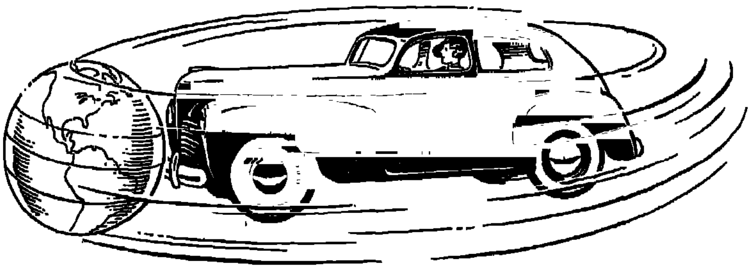


FIG. 67. The egotist: "The world revolves around me."

make the worst possible driver. He would consider nothing but his own interests and immediate desires.

The babyish adult makes a miserable driver for the same reason. He has never outgrown his babyish egotism. He may have had the kind of training that makes a grown-up person act like a baby.

On the highway, this egotistical type of person betrays himself by such practices as:

- Pulling out of line and disconcerting others.
- Stopping or making turns without signaling.
- Making turns from improper traffic lanes.
- Cutting in too closely after passing.
- Not staying on his own side of the road.
- Boasting of breaking traffic laws.
- Being over-confident, believing that all accidents happen to the other fellow.
- "Chiseling in" and demanding the right-of-way.
- Using influence and "pull" for ticket fixing, regardless of what this practice means in terms of public harm.
- Parking double, for his own convenience.

Parking his car so that it occupies almost two parking spaces.

Pulling out from the curb without signaling or looking for approaching cars.

The egotist is a psychological misfit in the traffic picture.

The Show-off

Like the egotist, the man who shows off discloses that he has never properly grown up. He has never managed, no matter what his age, to get both feet on the ground and to see himself in his proper place among other men and women. He is exactly like the child who enjoys dangling his lolly-pop in other children's faces! He is competitive and boastful. Often he is suffering from a half-recognized sense of inferiority which he is trying to cover up by false appearance of superiority.

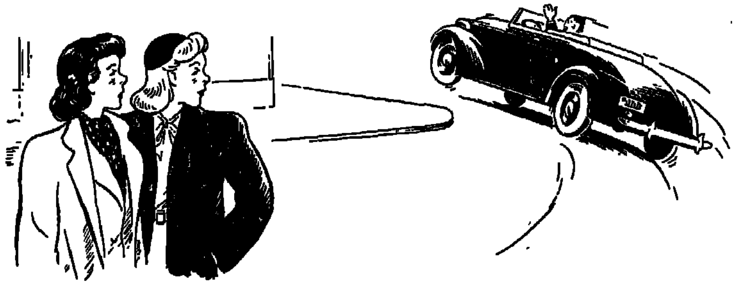


FIG. 68. How do you react to show-off driving?

He is a bad risk as a driver because of practices like the following:

Driving too fast for conditions.

Driving more recklessly the larger his audience.

Creating near emergencies to prove that he can get out of them.

Boasting of his car's speed and power.

Boasting of the time he makes between places.

Acting more for showmanship than for sportsmanship.

Passing other cars at risky places and then talking about his luck.

Painting his car with "loud" colors and smart remarks or plastering it with stickers.

Always being ready to prove he can "stop on a dime."

Always being ready to take a chance or to "try anything once."

Being willing to turn the highway into a race-track.

Boasting that he can drive just as well after a drink or two.

Never letting others reach home from a party ahead of him.

Always taking a dare.

Passing red lights and stop signs with an air of bravado.

Wanting to give the impression that he drives like "a man who has been around a lot."

Even the car itself seems to swagger at the touch of the show-off. Admired by none, the "smart-aleck" is likely to think he is admired by all.

The Emotionally Uncontrolled

Uncontrolled emotions are another sign of immaturity. A baby does not have the problem of controlling his emotions; he just expresses them. Ability to control emotions to a reasonable degree and to remain calm under stress should be developed as you grow older. With proper training and determination, such emotional control is achieved by the time you reach adulthood.

But some persons are never more than over-grown babies as far as their emotions are concerned. They take the slightest criticism as a personal offense. They whine and sulk and become resentful. Unimportant trifles seem big to them. We say they "make mountains out of mole-hills." Their emotional development has been stunted. They have never really grown up. We call them unstable, which means that they cannot be depended on to do the right things.

Persons with stunted emotional development show certain

characteristic driving faults. Psychological trouble-shooters can spot them because they:

Lack presence of mind in emergencies.

Get "upset" over trifles, or are nervous in unusual situations.

Lose their temper and, consequently, their judgment.

Express anger by driving recklessly.

Exhibit impatience in traffic jams and start irrational horn-blowing.

Call traffic officers by abusive names.

Resort to boorish crowding.

Are easily distracted from the main business of driving.

Childish emotions are responsible for a great many traffic accidents.

The Rationalizer

Then there is the person who never learns to face facts squarely. He finds it easy to see a thing the way he wants to see it, rather than the way it really is. He will not admit his own faults. If involved in an accident, he blames the driver of another car, the traffic regulations, the road, a "back-seat" driver, his own car—anyone and anything but himself.

Such a person is clever at finding plausible-sounding arguments to excuse everything—even the obviously wrong. We call him a "rationalizer." He fails conspicuously in sportsmanlike driving.

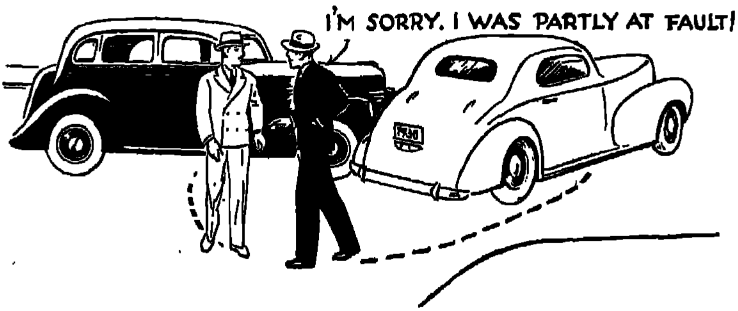


FIG. 69. No "rationalizer" here!

The Thwarted

Some persons do absurd things to compensate for failure. There is a strong desire in man to be masterful, to achieve something, to assert himself and display his power. If circumstances prevent him from showing mastery in one situation he tends to show it in another. A familiar example is the man who does not amount to much at the office and so lords it over everybody at home.

The little, unimportant fellow looks for a chance to appear powerful. The really important man doesn't need to hunt for artificial outlets, for his desires for mastery and self-expression are being normally satisfied.

But watch the little, thwarted man step into a car. Here is power at his disposal! What will he do with it? The psychological trouble-shooter will find him:

Insisting on the right-of-way.
Arguing a traffic point to death.
Talking "big" to traffic officers and other drivers.
Showing the road practices of the egotist.

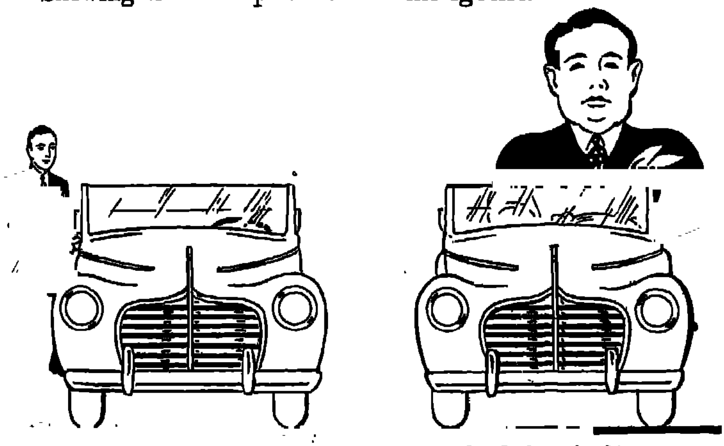


FIG. 70. Before and after he gets behind the wheel!

Trying to bully others.
"Giving his dust" to smaller or older cars.
Edging in to cheat someone out of a parking space.

Making pedestrians scramble to safety.

Not moving over when another driver signals he wants to pass.

"Getting even" with drivers who pass him.

He is always trying to give an artificial boost to his poor little self-esteem.

Of course, he shows himself up as an unimportant fellow who is borrowing a feeling of personal power from his car. But the foolish things he does may lead to tragic or expensive accidents.

THE MENTAL MAKE-UP OF A TOP-NOTCH DRIVER

From a psychological point of view, the top-notch driver is one with, not only motor skill, but *balance* and *self-control.* These characteristics indicate sound adjustment and maturity. They show up in:

A sense of responsibility
Good sportsmanship
Foresight
Controlled attention
Good judgment

Responsibility and Sportsmanship

You will find it difficult to draw a sharp dividing line between good sportsmanship and a sense of responsibility.

Good sportsmanship is made up of the courtesy and reasonableness that come from a desire for *fair sharing.* This social desire means that the driver senses the traffic situation, not merely from his personal point of view, but from the point of view of other highway users. His driving practices will then be quite the opposite from those of the babyish, egotistical,

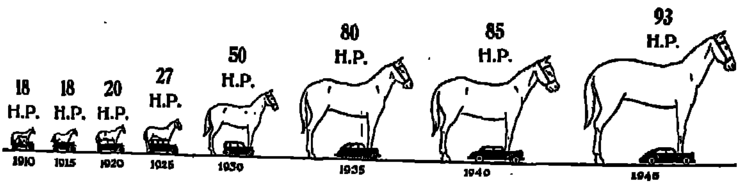


Fig. 71. Increased horsepower requires increased sense of responsibility.

over-emotional, unbalanced trouble-makers we have been analyzing. He, too, is easily spotted on the highway. His good attitude reflects his mental make-up. Sound driver training is producing this kind of driver in increasing numbers.

Judgment

Good judgment is not the mysterious gift that some people suppose. It is a mental product of sound training.

You think more soundly about the affairs you thoroughly understand. The business of driving an automobile in traffic offers no exception. A background of education and training is the foundation for good judgment. Experience is a building block, not only of skill, but of the mental qualities of the good driver.

The driver of good judgment is constantly sizing up the traffic situation and is not caught short in the pinch. A person of imagination, he makes decisions and reactions that help keep the traffic pattern sane and safe.

Attention

A conspicuous quality of the driver of mature psychological make-up is controlled attention.

The man who cannot control his own attention is not fit to control a car. Imagine a man steering a fast-moving object on a shared highway if his mind, like that of a child, is at the mercy of any accidental happening! Attention has to be whipped into place and held there.

The psychologically fit driver is able to attend to business. His business is the total traffic pattern. He drives ahead. That is, he knows everything that is happening, in his whole field of vision, that could possibly affect the driving picture. His clearest attention is focused on *the path that the car should take.*

It is a fact that there is a strong tendency to steer toward the spot to which you attend. The muscles of your body tend to adjust toward the goal of your attention. You have seen a bicycle rider, for example, turn his wheel toward the spot towards which he looks, without knowing he does it. A driver

whose attention is so poorly controlled that he turns his head toward accidental distractions is liable to steer his car unconsciously in the same direction.

John Doe was a man of childish, uncontrolled attention. A commotion made by his hunting dog in the back seat of his car drew his attention. He looked over his right shoulder. In a split second, his car had crashed into a telephone pole at the right side of the road.

Mrs. Doe thought she could drive down a city street and, at the same time, watch for an obscure house number on the left. She crashed into a car traveling in the left lane, because she unconsciously steered that way.

Situations that threaten to distract the attention of uncontrolled persons may be:

- The scene of an accident
- Novel things in passing
- Fine views
- A member of the opposite sex—in or out of the car
- A back-seat driver
- Arguments
- A bee or wasp in the car
- A hat blowing off, a skirt blowing up, or things placed on the seat blowing away
- Sharp light reflections

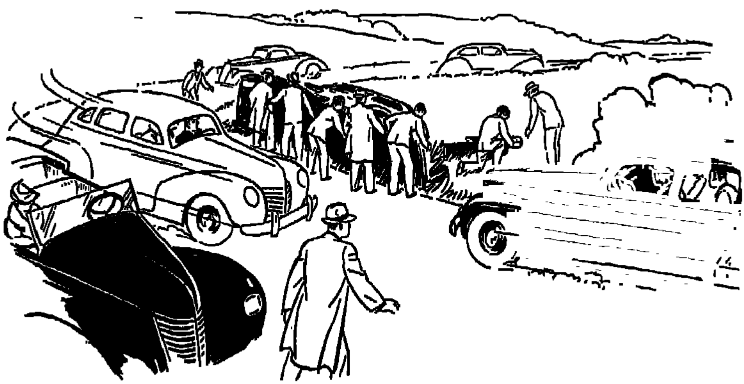


Fig. 72. The scene of an accident can distract attention.

Pets and children in the car
A thousand and one other things

Control, whether of emotions, attitudes, or attention marks the person who is psychologically mature.

Foresight

Some drivers develop a high degree of foresight. They see and think ahead. They keep control and avoid trouble by recognizing *trouble-in-the-making.*

School children are walking or playing along the road. One is about to catch a ball. Suppose he misses it. Will he dart after it into the road? The driver who foresees this possibility may save the child's life.

A parked car some distance ahead has fumes coming from its exhaust. Is it about to pull out into the line of traffic?

In the distance, an impatient driver is nosing out around a truck. He is obviously misjudging your speed as you approach him. He will be forced to cut in sharply. Your anticipation of the situation avoids a wreck.

Ahead, a pedestrian is crossing the street. Will he slip, or become confused, or change his mind and direction? The driver with foresight is prepared.

You observe a slight movement at the left front door of a parked car. Someone is about to step out on the wrong side without knowing that your car is approaching. This may be trouble-in-the-making.

The driver you are following is erratic. His speed is not steady. He slows down at unexpected places, without signaling, and then darts on ahead. He does not keep to his side of the center line. You prepare to take no chances with him.

Some distance ahead you see a strip of icy road, a section of wet pavement, a large puddle of water. You anticipate what could happen if you were compelled suddenly to apply your brakes on that particular spot.

You are about to emerge from a deep cut through a hill. You know it is a windy day and there will be a strong crosswind at the edge of the cut. There will be a strong sideward

thrust on your car because of the wind. Your foresight makes you ready for it, and it will not catch you napping at your steering.

You are on a through-traffic street or highway. Ahead is an intersection with a "stop" sign protecting you. You see a car on the cross road moving too rapidly toward the "stop" sign. Will the driver be able to stop where he should? Does he even see the sign? You have the "right-of-way." But, more important, you have foresight.

The mental make-up of a driver is as important as his skill. It is likely to determine what he will do when he has power in his hands.

THE THRILL OF POWER

Most persons like strong, powerful things and forces. They like mighty seas and high mountains. They are fascinated by brilliant fires and thundering waterfalls, by strong men and forceful machines. They identify themselves with mighty things and get a thrill of reflected power.

So it is not surprising that the power of the automobile is a source of thrill. You can identify yourself with this machine, step into it, drive it yourself, and "step-up" your power. Here, indeed, is an opportunity for glorified self-expression!

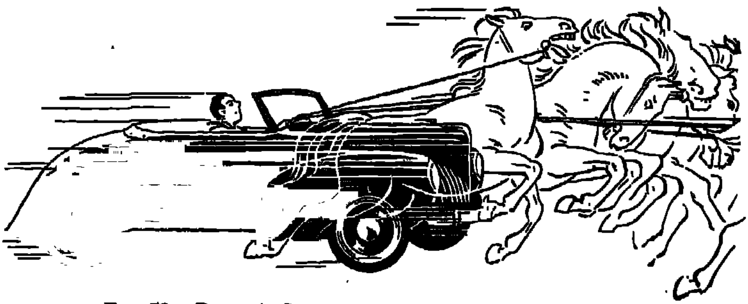


FIG. 78. Power! Its mastery marks the expert driver.

But there are two important things to remember when appropriating power:

1. Power has thrill and romance only when in control.

Man is reduced to a weak and foolish-looking creature when the power he is supposed to be directing runs away with him. He faces this fact now with the atomic bomb he has created. Either he controls it or it destroys him. Instead of the satisfaction of mastery, he suffers the dissatisfaction of defeat. It is not simply power that man wants, it is *power under control.*

All drivers have the sense of power. Only good drivers have the sense of power under control.

2. How one uses power discloses just what kind of person he is, and the degree to which he has reached maturity. Any power—whether of money, office, political prominence, or a fine car—makes a foolish man look more foolish and wise man look wiser.

   What you do as a pedestrian may be mild enough to deceive, but when you get behind the wheel of a powerful car, every personal quality you have, good or bad, is magnified. Power in your hands shows up the real YOU!

DISCUSSION TOPICS

1. Give examples of the conduct of unstable persons whom you know. In what situations would they make bad risks on the highway?
2. Discuss the proneness of people to blame the other fellow for accidents (a) in sports; (b) in the home; (c) when driving.
3. Explain the rudeness some drivers show to pedestrians and small-car owners. How different is their behavior when encountering heavy trucks and fine cars?
4. Discuss the drivers in the following traffic incidents. Explain the psychology of each:

   M is approaching an intersection. He sees that the light is about to turn green. He speeds on the wrong side of the street and cuts in front of waiting vehicles.

   R has the reputation of always getting to the game first. This time a car is ahead of him. A pal dares him to prove he is the fastest driver in the group. He takes many chances, breaks traffic regulations, takes unfair advantage at a stop sign, and crowds ahead.

   C approaches an intersection at about the same time as a little old car from the cross street on his right. The other car passes through first whereupon C crowds him to the curb, "bawls him out," takes his license number, and threatens to report him for stealing the right-of-way.

S tries to pass a truck near a hill-crest. A fast car approaches from the opposite direction and a three-car crash results. S defends himself by saying that the person sitting beside him insisted that he had plenty of room to pass.

F got "sore" at a back-seat driver, threw caution to the winds, and drove home at break-neck speed.

K was driving in the lane next to the center on a four-lane street. At the last moment, too late for proper maneuvering and signaling, he discovered he was to turn right at the next intersection. He lurched his car across to the right. Only by jamming on his brakes and squeezing to the curb did a driver of a car going in the same direction in the lane nearest the curb avoid a crash.

Describe other cases of bad risks as drivers and try to explain their psychology.

5. Report instances you know of where the driver lost control of the car and the situation because of uncontrolled attention.
6. Report instances where small distractions have caused accidents.
7. Discuss, "Power in your hands shows up the real you." Illustrate.

PROJECTS

1. Map out a course of self-training that would help anyone with a self-centered attitude acquire a social point of view.
2. Study critically your own responses in traffic situations. Do you show any tendencies towards the practices of persons who make "bad risks" as drivers? This is a very difficult project to carry out. It is not easy for one to analyze himself with fairness. But it is decidedly worth-while to try. If you show tendencies toward an unfavorable psychological make-up, what can you do about it?
3. Draw a diagram of a traffic situation (a) as it is first seen in the distance, and (b) as it changes into a hazard by the time the driver catches up with it. Show how proper foresight could, in this case, avert trouble.
4. PERSONAL RATING PROJECT. Make an appraisal of yourself. The following tables are only in a suggestive form and are by no means complete. On large sheets of paper, prepare similar but more complete tables for your ratings, using the text to suggest what items to include.

   In using rating tables VI and VII:

   (a) Rate yourself

   (b) Have others rate you.

FOR FURTHER READING

The Accident-Prone Driver. House Document No. 462, Part 6, Government Printing Office, Washington, D. C. 1938. 52 pp.

Psychology and the Motorist. Toops, Herbert A., and Haven, S. Edson. R. G. Adams and Co., Columbus, Ohio. 1938. 265 pp.

PHYSICAL CHARACTERISTICS

Which Can Be Specifically Measured

Refer to the text. Add any other items for which you can secure definite measurements and interpretations

TRAIT	READING	Rough Interpretation			COMMENTS
		Above Average	Average	Below Average	
Strength of Grip Stronger hand Weaker hand					
Visual Acuity (with glasses) Right eye Left eye Both eyes					
Field of Vision Right eye Left eye Both eyes					
Color Perception Both eyes					
Depth Perception Both eyes					
Auditory Acuity Right ear Left ear					

TABLE V

GENERAL PERSONAL CHARACTERISTICS

Be sure to refer to the text. Add such other items as you believe you can reasonably well rate

TRAIT OR CHARACTERISTIC	Rough Interpretation			COMMENTS
	Above Average	Average	Below Average	
Health				
Disability				
Nervous Stability				
Control of Attention				
Reliability				
Courtesy				
Habits of Observation				
Presence of Mind				
Sportsmanship				

TABLE VI

ADDITIONAL APPRAISALS

For Persons Who Are Already Driving a Car

Be sure to refer to the text. List habits as specifically as possible. The more specific you make these, the more helpful will be your self-analysis. *Many* more items should be listed than are shown below.

List of Wise Habits	Habit Well-Formed	Fairly Well-Formed Habit	Habit Not Formed	COMMENTS
Mechanical operations, Shifting gears. Steering accurately. (List others)				
Regularly inspecting the car's safety equipment.				
Observing traffic laws, signs and signals.				
Practicing highway courtesy.				
Keeping in the line of traffic.				
Driving with proper appreciation of the "danger zone."				
Slowing down at potential danger points.				
Starting to appointments on time.				
Avoiding driving when fatigued.				
Avoiding driving after drinking.				
Judgments Overtaking and passing (List others)				
Making quick and correct decisions.				
Always "driving ahead."				

TABLE VII

CHAPTER VIII

Sportsmanlike Pedestrians

Do You Know:

- **The serious trend of pedestrian traffic fatalities?**
- **When and where pedestrians are most likely to be in accidents?**
- **What attitudes are most favorable to pedestrian safety?**
- **The traffic hazards of pedestrians at night?**
- **How pedestrians should be protected?**

THE MAN ON FOOT

THE MOTOR age has had serious consequences for the man on foot.

Three decades ago there was no great hazard in crossing the street or walking along the highway. Horses and wagons were easy to cope with. The pedestrian had time to get out of the way.

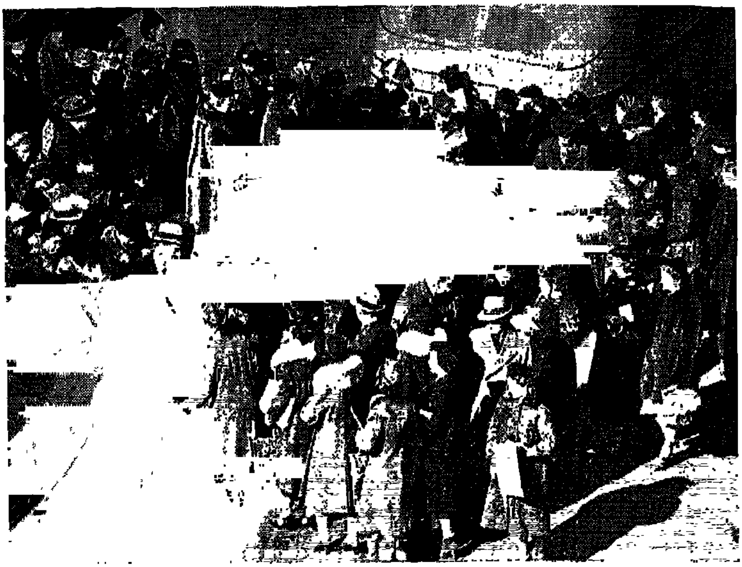
Today, however, a pedestrian may wait several minutes before daring to cross a busy street. Even then he may cross with apprehensive glances this way and that, and with the jumpy feeling that a speedy 3,000-pound car may be at his heels.

Safe walking on streets and highways has become a problem. The pedestrian is "on the spot."

During the last quarter century, the use of motor vehicles has so rapidly increased, and such large masses of population have shifted to city centers, that traffic congestions often make difficult and dangerous situations for drivers and pedestrians alike.

Pedestrian Accidents

Two out of five people killed in automobile accidents in the United States are pedestrians. In some localities the proportion is even greater. The New York City Police Department reported that 85 per cent of all the city's traffic deaths in one year involved pedestrians. In one year, 5,860 were injured



Courtesy, Washington Evening Star

FIG. 74. A rush hour traffic scene. Pedestrians greatly outnumber motor vehicles at many busy locations.

or killed while crossing the street against the red light, and 6,119 while crossing between intersections. In cities over 500,000 population, 4 out of 5 persons killed in traffic are pedestrians.

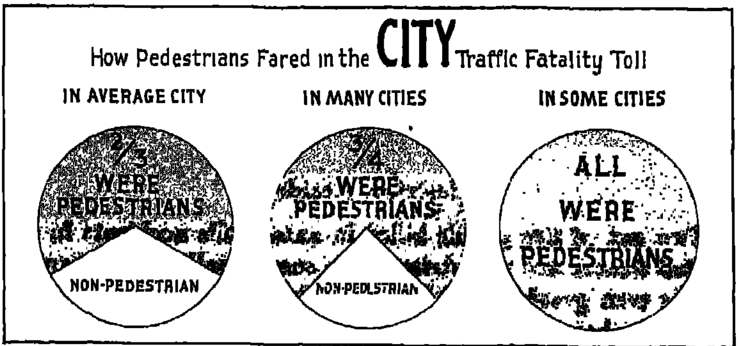


FIG. 75. Pedestrians fare badly in city traffic.

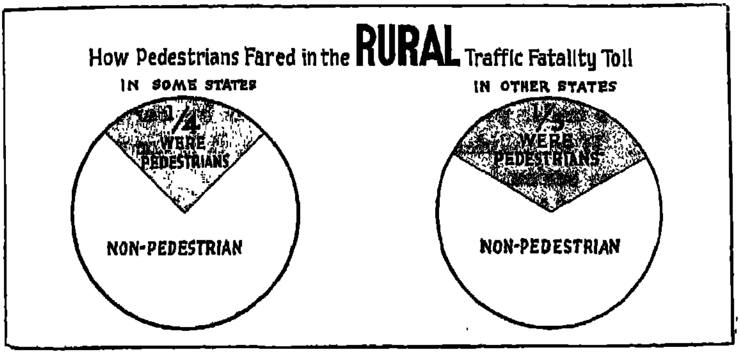


FIG. 76. The rural pedestrian fatality toll is high.

Even in cities where non-pedestrian accidents have been reduced, the trend of pedestrian fatalities is often found to be upward.

In one year, in the United States, 572,000 automobile accidents caused injury or death. In these accidents, 234,700 adult pedestrians and children were hit by automobiles. To 9,700 pedestrians the result was death! Clearly, the motor age has given the man on foot a serious problem.

Man Versus Car

In any competition between pedestrian and automobile, the pedestrian is obviously at a disadvantage. The automobile

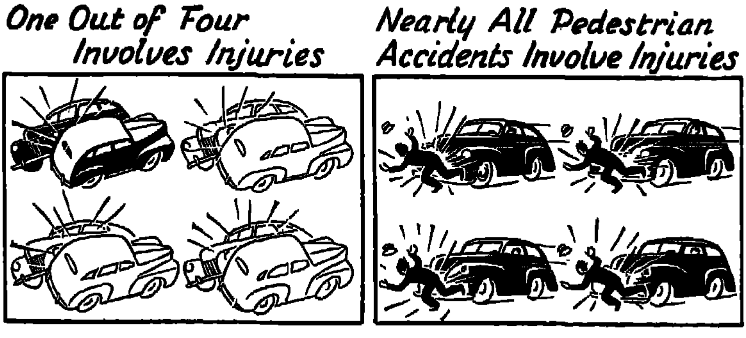


FIG. 77. Pedestrians, when hit, seldom escape serious injury.

has the better of it in power, size, weight, speed, momentum, force of impact, and hardness of material.

Flesh and bones are much weaker than steel, glass, and rubber tires under pressure. The driver in his car is encased in armor. If he collides with a pedestrian, it is the pedestrian who is more seriously injured.

The force of impact of a 135-pound pedestrian walking at 3 or 4 miles per hour has no chance against the force of impact of a 3000-pound machine traveling at the 20 miles per hour

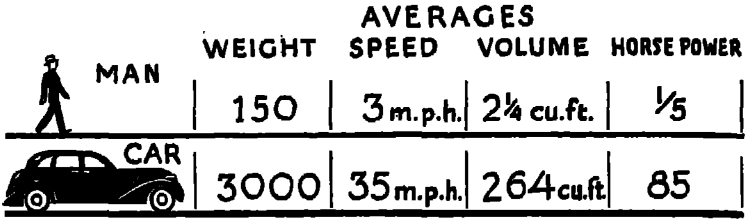


FIG. 78. The under-dog on every score. The pedestrian is no match for the car.

speed which is legal in most city traffic—to say nothing of the legitimate 45 or 50 miles per hour on many rural highways.

Furthermore, the speed with which an accident situation takes form is usually so great that the pedestrian has little chance to get out of the way. The car has complete advantage.

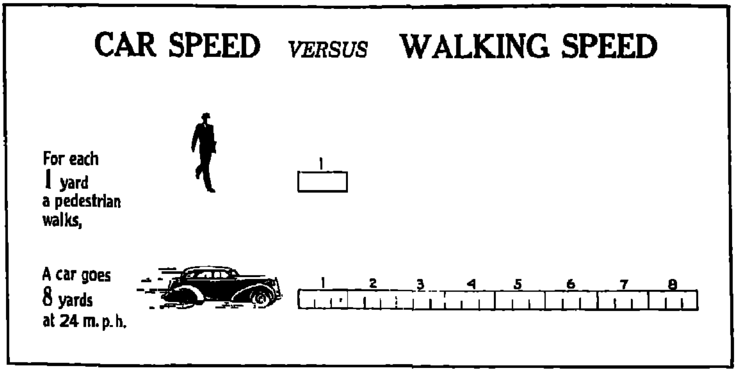


FIG. 79. Adult pedestrians walk at about 3 miles per hour. To figure out the ratio of car speed to pedestrian speed, divide the car's speed in miles per hour by three.

Obviously, the causes for street and highway conflicts between car and pedestrian must be searched out and corrected. Driver attitude has been found to be an important factor in traffic safety. Pedestrian attitude is equally important.

NEW PEDESTRIAN ATTITUDES

Actually, the prime traffic interest of both driver and pedestrian is essentially the same—that of a safe, convenient, and pleasant sharing of streets and highways. The regulations for street and highway use make dangerous conflicts between driver and pedestrian unlikely except when either the driver or the pedestrian fails to do his duty.

The man on foot must bring his attitude up to date.

Before the motor age, the pedestrian was able to use the streets and highways in a carefree manner without much caution or alarm. An English jurist, early in this century, handed down a decision to the effect that, "According to the law, and when on the public highway, the pedestrian may walk

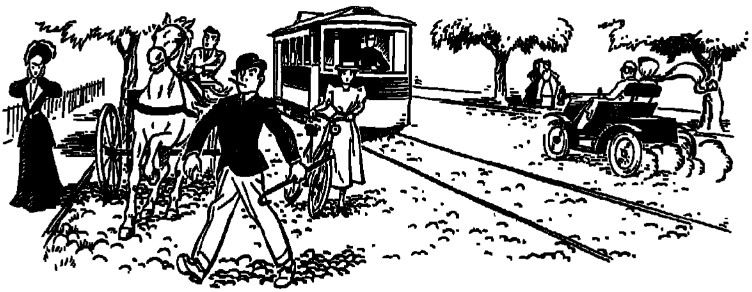


FIG. 80. ". . . be that progress never so stupid."

anywhere, or how . . . and no constable may deny him progress, be that progress never so stupid."

In this motor age, no pedestrian can afford a "progress" that is stupid.

The pedestrian, it is true, was here before the motor vehicle. But the idea that he has the right to walk where and when he pleases is outmoded by the mechanical trend of civilization.

The modern attitude concerning the pedestrian is in line with a Connecticut law to the effect that:

> "Any pedestrian who shall use any street or highway negligently or recklessly or shall wilfully fail to obey the signal of any traffic officer or shall recklessly disregard his own safety or the safety of any person by the manner of his use of any street or highway, shall be fined not less than two nor more than twenty-five dollars for each offense."

The pedestrian, as well as the driver, is obliged to contribute to the safety of the traffic pattern by *planning his course* so as to use the safest path and the safest timing to get to his destination.

Walking along highways or crossing streets demands good judgment, fair play, and cooperation on the part of both motorists and pedestrians. Such cooperation should be easy, for the driver and the pedestrian are actually the same person at different moments. The pedestrian has been rightly called "the driver who has just parked his car." The driver is the man on foot who has just stepped into his car. Each should

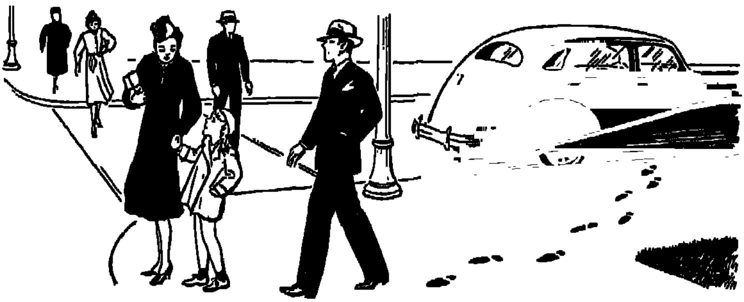


FIG. 81. The driver becomes a pedestrian. Does he change his attitude towards drivers?

find it easy to get the other's point of view in traffic. Each has his obligations toward traffic safety. The pedestrian with a modern attitude conforms to pedestrian traffic regulations.

To help lower the serious traffic fatality rate of pedestrians, you, as a driver, must realize the limitations and handicaps of the pedestrian, under what conditions pedestrian accidents are liable to occur, and at what age levels pedestrians most often suffer traffic accidents.

MEET THE PEDESTRIAN

You have already studied the psychology of the driver to understand why he often behaves as he does. Suppose you analyze the pedestrian to see who he is and why he so often helps to cause traffic accidents.

The pedestrian is no special person. He is any man, woman, or child walking on a street or highway. He may have any of the physical and mental limitations known to you.

Handicapped Pedestrians

Many persons have serious handicaps in traffic. Some pedestrians are handicapped by defective eye-sight or hearing; some lack agility, balance, and walking skill; others have bodily diseases that prevent sound judgment.

Drivers should be quick to recognize the white cane or the guide dog which indicates a blind pedestrian. Other handicapping physical defects, such as deafness, are much less easily recognized. The safest attitude of a driver toward any pedestrian who seems awkward, out of order, or slow in any traffic situation is that he may be a handicapped person who needs consideration and assistance.

Some persons are so exceptionally slow in reaction that, even after they see danger, they are incapable of making quick, decisive, and correct movements. The man who is crossing the street ahead of your car may be in poor health, crippled, drunk, aged, or so tired that he is liable to do the wrong thing. In fact, there are so many possible physical deficiencies that some drivers feel that the best policy is to drive as though every pedestrian on the street had some infirmity!

The man on foot is sometimes accused of traffic reactions that show anything from negligence to stupidity. No wonder! He may actually be stupid.

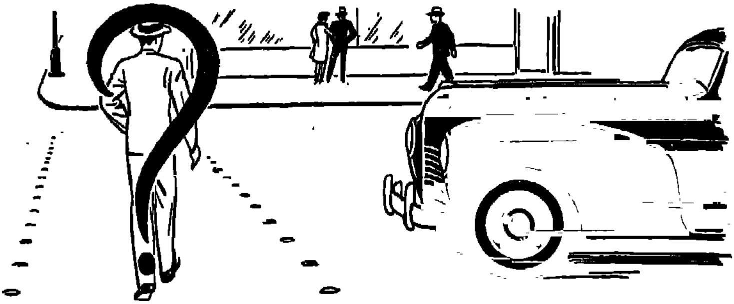


FIG. 82. Is he deaf? Almost blind? Crippled? Confused? . . .

A community of any size includes people of a wide range of mental ability. Some of these people have exceptionally high intelligence. But just as many people are exceptionally dull. Many persons are definitely feebleminded, and an occasional one is so dull mentally that he is as incapable as a four-year-old child of guarding himself in traffic. This mental dullness is something he cannot help. He can no more control it than he can control the color of his eyes or skin. Informed drivers realize that such a pedestrian is to be treated with the same kindness and care that is due a child of four or five. He fails to use caution because he lacks good judgment, has very little foresight, and cannot analyze the situation to see danger. He is no more to be laughed at or reprimanded for his stupid acts than a person who is physically crippled is to be blamed for his lack of grace or agility. The stupid person is mentally like a cripple, and he needs every assistance a driver can give him.

In addition to dullness, there are dozens of other mental characteristics that contribute to pedestrian accidents. The driver has to count on an extra margin of safety in his stopping distance, because, for all he knows, the man walking in the street may be:

Afraid and confused
Bewildered when alighting from cars and busses
Absent-minded
In a hurry—which is often suicidal in traffic

Ignorant of traffic rules
Falsely believing that traffic signals are only for drivers
Using poor judgment
Assuming bad attitudes of—
    Stubbornness
    Defiance
    Unfairness
    Selfishness
Over-optimistic—trusting too much to luck or to the ability of the driver to avoid trouble
Intoxicated

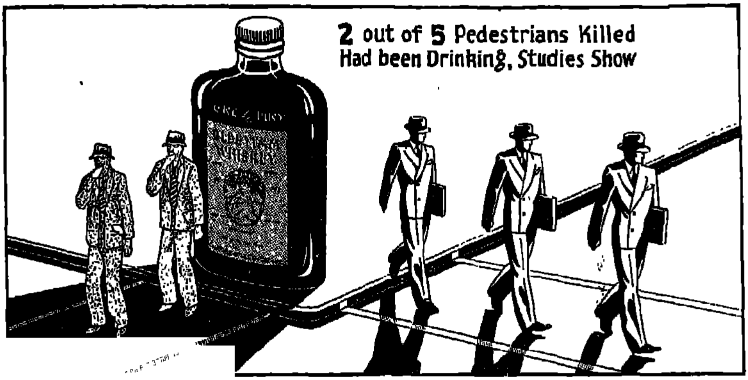


FIG. 88. Alcohol and walking on the streets mix no better than alcohol and driving.

More adult pedestrians who are killed have been drinking substantial amounts of intoxicants than is generally believed. Studies in New York City (321 cases), and in the Cleveland, Ohio area (193 cases), showed that 2 out of 5 adult pedestrians killed had been drinking excessively. If he is even slightly intoxicated, the pedestrian constitutes what the Cleveland Police force has aptly named "an accident about to happen."

In fact, any of the above characteristics or conditions may make the pedestrian one who, unknowingly, may be setting the scene for a traffic accident. In such a case, a conscientious driver accepts the responsibility for protecting him.

The Age of Pedestrian Victims

An analysis of 201,601 pedestrian accidents, fatal and non-fatal, as reported by 13 states, shows that, in proportion to their numbers in the whole population, persons in the two age-groups, 5 to 14 years, and 65 years and over, have the highest pedestrian accident rates. Pedestrians between 15 and 24 years of age have the lowest accident rate —about ⅓ that of the two worst age groups.

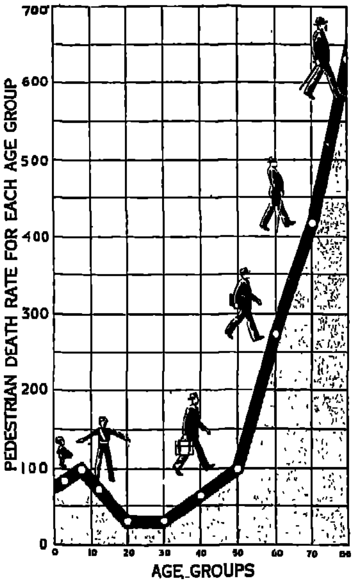


FIG. 84. Street crossings are especially hazardous for elderly pedestrians.

Elderly Pedestrians—Persons past 50 years of age have the worst pedestrian *fatality* rates, the rate growing much higher with increasing age. About ½ of the pedestrians killed are 50 years of age or older. Yet only about ⅙ of our population is aged 50 or over.

Child Pedestrians—Of the pedestrians killed in traffic accidents, 21% are under 15 years of age. According to studies that have been made in Washington, D. C. and Philadelphia, about ¾ of the children killed in traffic accidents were killed at play.

In congested city districts where proper playgrounds have not been provided, children play in the street. They "hitch on" to trucks, try to beat cars across the street, chase balls into the paths of cars, and dart out unexpectedly from between

parked cars. In the excitement of play, they fail to stay out of the way of traffic.

The age range of 5 to 14 years is especially dangerous because of the active, independent play activities of children within these ages. One out of every eleven pedestrians injured involves a child playing in the streets. In one year, 2,000 children between these ages were killed by automobiles. Many others were crippled for life.

PROTECTING THE PEDESTRIAN

The pedestrian can so easily be the victim of today's rapid and heavy traffic that well-developed measures must be taken to protect him. A pedestrian protection program should include such helps as:

- Off-the-street play places
- In-school training program
- Radio and newspaper guides in good pedestrian practices and driver responsibilities
- Special after-dark aids
- Good driver training course
- Adequate pedestrian pavement markings
- Campaigns against jay-walking
- Enforcement of pedestrian regulations
- Proper pedestrian walks and crossings

FIG. 85. Attractive play yards keep pre-school children off the street.

Play Places

The only satisfactory solution to the problem of child deaths while at play is to provide safe play places away from the streets. In the case of toddlers and pre-school children, this can often be done by parents themselves by making attractive play yards at home.

For older children, community playgrounds should be provided. They must be areas carefully selected, well equipped, supervised, and made so attractive that children will be happy to play in them. Then regulations forbidding play on streets

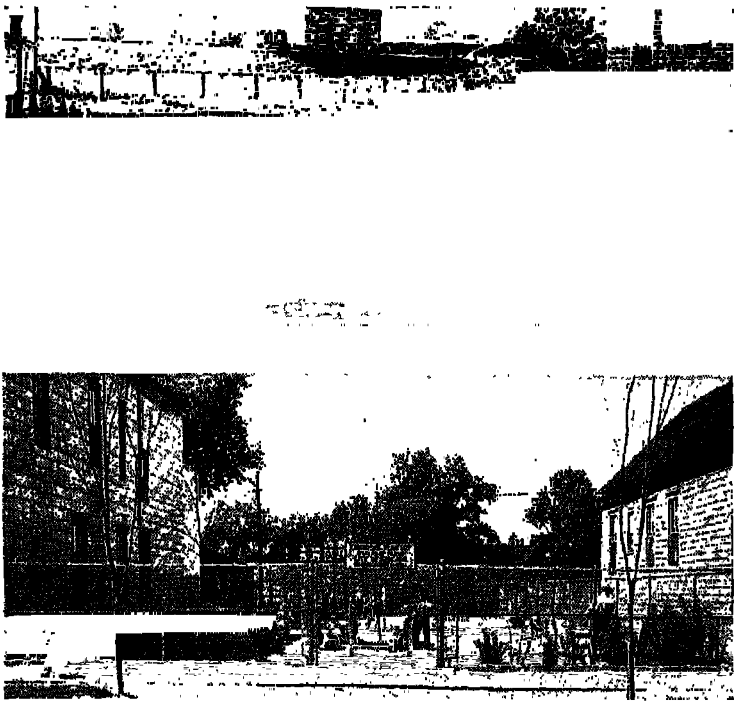


Fig. 86. Community playgrounds are the solution to many traffic fatalities. These "before" and "after" pictures from Chicago show what can be done with vacant properties to provide neighborhood playgrounds and remove "eye-sores."

should be made and strictly enforced. This is the one effective solution to the serious problem of child deaths while at play.

Children are normally impulsive. They get an idea and act on it immediately. So it is perfectly natural for playing children to act suddenly and without caution. Until the time comes when playing children are kept entirely off streets, you, as a driver, must assume complete responsibility for their safety. You must drive as though assuming that every playing child is about to dart in front of your car. Children cannot be depended on to be cautious. So you, the driver, must be cautious.

Pedestrian Education

Children under 5 or 6 years of age should be trained to stay off roadways. As this is the pre-school group, the major part of the training and discipline must come from parents and older brothers and sisters.

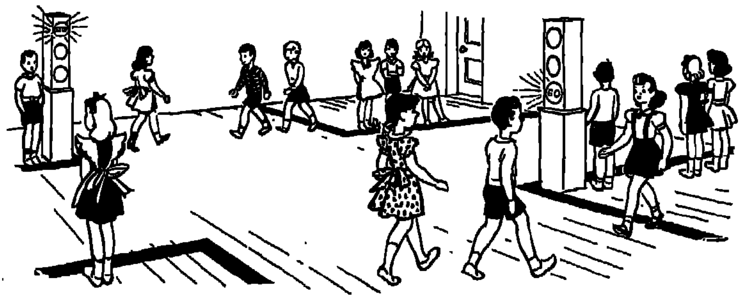


FIG. 87. Acting out traffic practices.

Children of school age can be trained to be good pedestrians. The skill and caution of grade school children has been greatly raised in recent years by well-planned public school programs in safety education. Children are taught safe pedestrian practices by means of stories, plays, posters, demonstrations, and games. They learn how to interpret traffic signals, when and where to cross streets, and to follow the directions of school safety patrols.

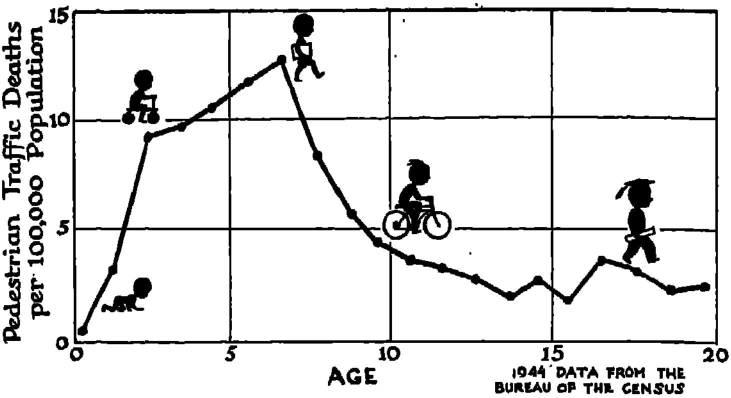


FIG. 88. Drop in traffic fatality rate at the school level.

Proof of the great value of this early school training in sound pedestrian practices is found in the rapid drop in child pedestrian fatalities at the six-year, or school-entering, age level.

While the accident rate of the grade school child has been decreasing, that of the high school group, between the ages of 15 and 19, has increased by 130%! Altogether too many of these accidents involve pedestrians. Evidently pedestrians over 15 years of age need to be effectively impressed with the neces-

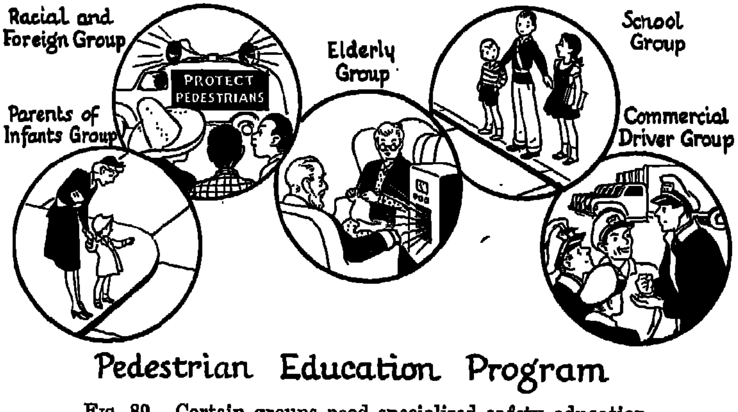


FIG. 89. Certain groups need specialized safety education.

sity of observing sound pedestrian practices. What an educational program has done for the grade school child it can do for the pedestrian over 15 years of age.

The Pedestrian at Night

Darkness greatly complicates the pedestrian problem.

The man on foot, especially if he is not a driver himself, often makes the mistake of believing that he can be seen by the driver from a far greater distance than is actually possible.

The headlights of a car look so bright to the pedestrian that he feels sure of being seen. He does not realize that, if he is wearing dark clothing, less than 5% of the light which falls on him is reflected back to the driver's eyes, and that this reflected light is all that lets the driver see him. The man on foot is almost invisible to the driver until the car is dangerously close. This is true even under the most favorable seeing conditions. If rain, snow, fog, a dirty windshield, inefficient headlights, or other conditions reduce the driver's visibility, the pedestrian can be seen only at a surprisingly short distance ahead.

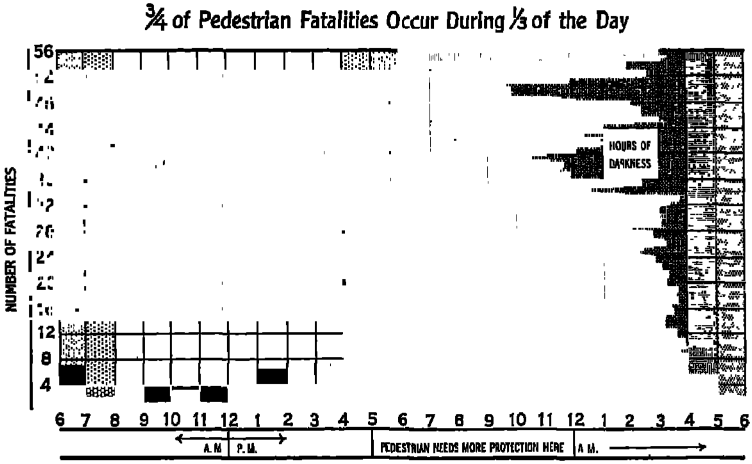


Fig. 90. Death after dark!

A study made by the Massachusetts Registry of Motor Vehicles shows in a startling way that the majority of pedestrians killed are meeting death after dark. Four out of five lost their lives between 5:00 P.M. and 1:00 A.M. Fig. 90 shows how seriously pedestrian accidents increase during hours of darkness.

Surveys of pedestrian accidents show these significant facts:

1. Darkness increases the general pedestrian hazard by 63 per cent.
2. Darkness almost doubles the hazard of pedestrians in the 15 to 39 year age group.
3. Darkness almost triples the hazard of pedestrians in the 40 to 64 year age group.
4. Adequate street lighting is helpful in increasing the driver's ability to see pedestrians.
5. Poor lighting of the highway is worse than none at all.
6. Efficient headlights greatly increase the distance at which drivers see pedestrians.
7. Pedestrian visibility greatly increases when the pedestrian wears some white clothing or reflector buttons.

Under the poorest conditions of road lighting, a pedestrian in all dark clothing can barely be seen as close as 90 feet. Consult the table for stopping distances in Chapter V. You will see that a car traveling at more than 30 miles per hour cannot usually be stopped in 90 feet. By wearing something white, the pedestrian can materially increase the distance at which he can be seen. To walk on the highway at night in all dark clothing is sheer folly.

Pedestrians with light-colored skins can be seen at night by drivers at a greater distance than pedestrians of darker skins. So persons with darker skins should take much greater precaution to wear or carry something white or bright.

Fair play in sharing the highway at night means that pedestrians must wear or carry something white or bright and that drivers must keep headlights in excellent conditions. Headlight deficiencies are more common than most drivers realize. The motor vehicle inspectors in New Jersey once reported

that 48 per cent of all vehicles inspected were rejected because of inadequate headlights.

The Non-Driving Pedestrian

Nine out of ten adult pedestrians killed are non-drivers.

Studies in Connecticut, Washington, D. C., and South Carolina show that unfamiliarity with the problems of driving plays a very significant part in pedestrian fatalities. Connecticut studied 1,031 deaths of pedestrians over 15 years of age and found that 95 per cent had never been licensed to drive. The pedestrian who has never driven is probably unfamiliar with the limitations of both motor car and driver, such as car stopping distances and the driver's inability to see pedestrians clearly at night.

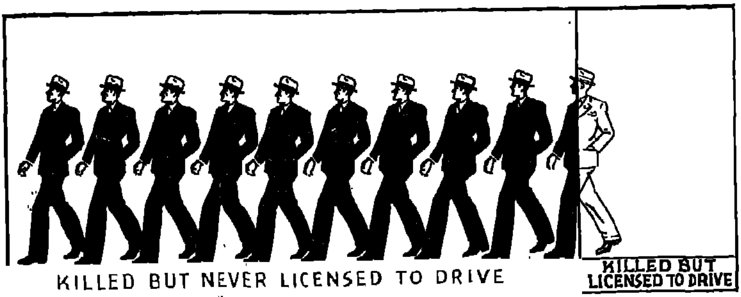


FIG. 91. Pedestrians who don't know how to drive are the chief traffic fatality victims.

Those who do not drive usually fail to sense the relative difficulty of stopping a motor car from even a medium speed of 25 to 30 miles an hour as compared with stopping themselves from a top walking speed of 3 to 4 miles an hour. They do not know the great difference in distance required. They seldom appreciate how much more difficult it is to change the direction of travel of an automobile quickly than to change one's walking direction. They rarely grasp how many different things must share the driver's attention.

Driver training, as a part of public school education, should help make the facts about car operation in traffic more gen-

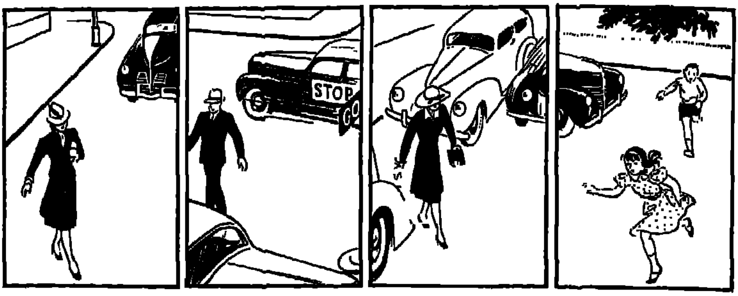
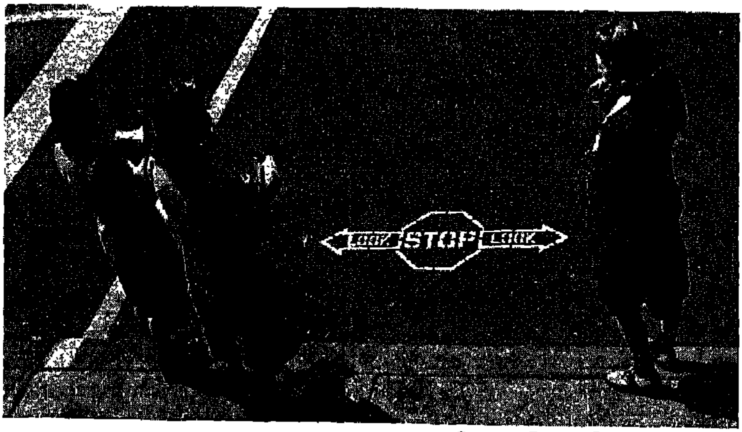


Fig. 92. Four unsound practices that take a heavy toll among pedestrians.

erally known. This should help bring a decrease in pedestrian fatalities.

The Jaywalker

There is one hopeful fact about traffic accidents involving pedestrians. The accidents fall into a small number of classes. A few bad pedestrian practices cause most of the trouble. Eliminate these bad practices and you eliminate a great many accidents.



Courtesy Detroit Police Department

Fig. 93. PAVEMENT SIGNS: Warning and guide signs are used for vehicle drivers. Why not use them for pedestrians? Other signs could read: "Pedestrians—Use Marked Crosswalks" or "Cross Only at Corners."

Most of these bad practices are really jay-walking practices. The majority of the pedestrians who are injured or killed on city streets were guilty of:

1. Crossing streets between intersections, that is, in the middle of the block.
2. Disregarding traffic lights, warning signs, and traffic police. Nearly three times as many pedestrians are hit crossing streets against red lights as are hit when crossing with the light.
3. Stepping out from the curb from between parked cars. More than 23,000 pedestrians are hit every year because of this dangerous practice.

Campaigns to make pedestrians realize the folly and the unfairness of jay-walking should help reduce pedestrian troubles. Many cities have effectively used pavement markings, posters, and conspicuous traffic signs to remind pedestrians of the folly of jay-walking.

CAUSES OF PEDESTRIAN ACCIDENTS

208	Were Crossing Not at Crosswalk..........	43.9%
73	Were Crossing In Crosswalk.............	15.4
44	Were Crossing Against Signal............	9.3
27	Were Coming From Between Parked Cars..	5.7
23	Were Walking In Street..................	4.8
21	Were Intoxicated	4.4
20	Were Boarding or Leaving Streetcar......	4.2
11	Were Crossing With Signal..............	2.3
7	Were On Sidewalk.......................	1.5
7	Were Crossing Diagonally................	1.5
5	Were Standing In Safety Zone...........	1.1
28	Actions Were Miscellaneous, Unknown or Unspecified	5.9
474*		100.0%

* (There were 22 double entries, though many more probably should have been included.)

TABLE VIII. What adult pedestrians were doing when fatal accident occurred, according to an eight-year study in Washington, D. C.

Table VIII sums up the causes of pedestrian accidents as found in an interesting eight-year study. It is perfectly clear that jay-walking and other unsportsmanlike pedestrian practices cause a large majority of the accidents analyzed.

Pedestrian traffic problems can be successfully solved only by a combination of good practices in driving and good practices in walking on streets and highways. The sportsmanship of fair sharing is required of both driver and pedestrian.

The public must show greater interest in pedestrian protection.

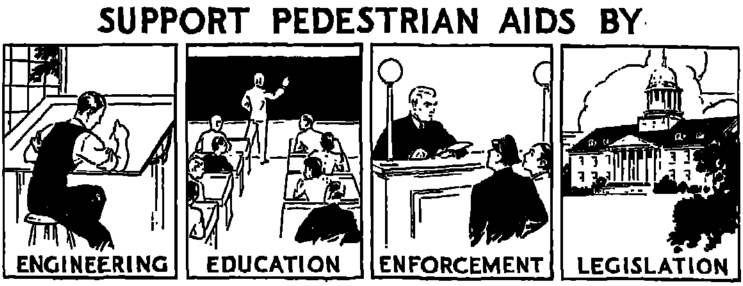


FIG. 94. Activities in behalf of your safety on streets and highways.

DISCUSSION TOPICS

1. Show how the pedestrian with a non-cooperative attitude can be a contributing cause in many types of accidents.
2. Discuss the point of view of the average pedestrian in regard to traffic. Is he generally antagonistic, resentful, and defiant? Or is he cooperative, understanding, and reasonable? Illustrate.
3. How can one's experience as a driver make him a better pedestrian? Or his experiences as a pedestrian make him a better driver?
4. What are some of the undesirable practices of pedestrians who have uncooperative attitudes? Discuss each one.
5. What specific suggestions can you make for improving the pedestrian accident record of young people?
6. What set-up in regard to illumination, road surface, car lighting, and pedestrian clothing would give the maximum pedestrian visibility at night? The minimum?
7. Why do persons between the ages of 15 and 24 have the lowest pedestrian accident rate?

8. How can non-drivers best be made to understand the problems and limitations of the driver?

PROJECTS

1. Analyze the records of traffic injuries and deaths in your own community. In what percentage were pedestrians involved?
2. Examine the traffic records of your community to find the number of persons between the ages of 15 and 19 that have been injured in traffic; below 15; between 19 and 39; 40 and 60; above 60. Are certain types of accidents found more frequently in one age-group than in others? Tabulate the kinds of accidents involving pedestrians.
3. Make trips at night, in both good and bad weather, for the purpose of getting a better and more definite idea of the driver's limitations for seeing a pedestrian, particularly one in dark clothing. Write a 200-word essay, based on your observations, advising a pedestrian how he should protect himself.
4. Report all things your community is doing specifically for the protection of the man on foot.
5. Spot, on a map of your community, the location of all pedestrian fatalities and injuries in the past year. What conclusions can you draw from this study?

FOR FURTHER READING

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PART II • Sound Driving Practices

CHAPTER IX

Traffic Laws Made by Nature

Do You Know:

How nature's laws affect driving?
The importance of friction to driving control?
How to drive so as not to conflict with natural laws?

NATURE'S LAWS DEMAND OBEDIENCE

IN BOTH city and country driving, many accidents result from the driver's ignorance of natural laws.

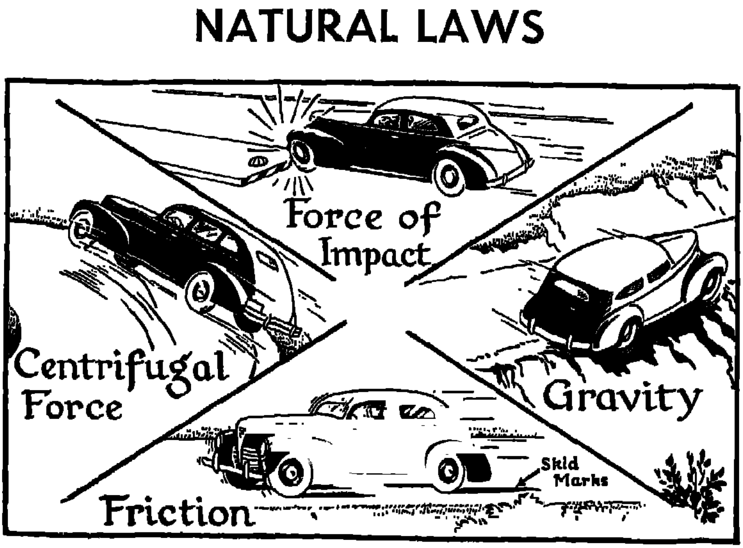


FIG. 95. Violations of natural laws carry their own immediate punishment.

Nature's laws work automatically, and, under certain conditions, are inescapable. Some of these natural laws affect driving so seriously that you cannot drive intelligently without knowing how they work.

FRICTION

The entire control of a moving automobile depends on the grip which four small areas of tire surface have on the road. This grip is called friction. Friction between the road and the tires enables an automobile to start, stop, turn, or to maintain traction. If there is no friction, there is no control, and an accident may result.

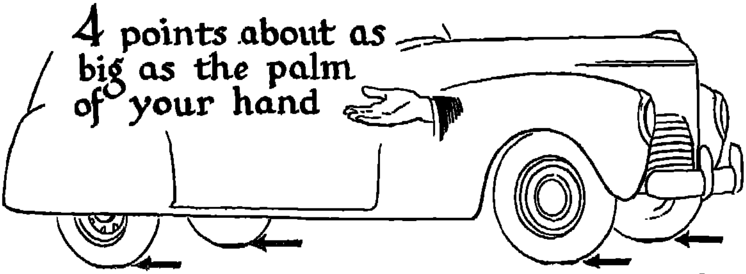


FIG. 96. Your control of the car depends materially on the friction at these four areas of contact between tires and road.

Starting and Stopping

The friction between the driving wheels and the pavement enables the car to start, stop, and keep moving.

The wheels of a car can move while the car remains stationary, as anyone who has seen the wheels spin in snow or mud knows. But, if the road surface is normal, friction exerts *a force under the rear wheels that pushes the car forward.* That push is what actually moves the car.

Friction is even more important in stopping. For, as the saying goes, "If yo' can't start, der yo' is, but if yo' can't stop, whar' is yo'?"

When brakes are applied, stopping friction takes hold in two ways:

1. The brake shoes, or bands, are forced against the brake drums
2. Friction between tires and roads creates a "road-push" in the direction opposite the motion of the car

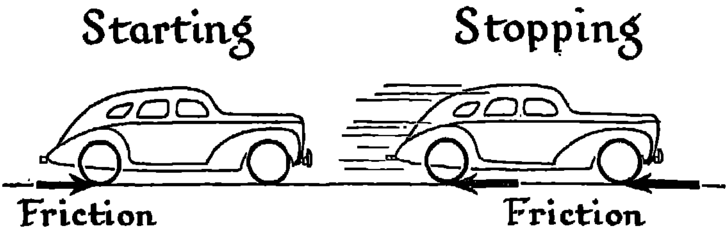


FIG. 97. Friction makes it possible for you to start and stop a car.

The force that results from the combination of these two sources of stopping friction is the braking force, or the force that actually stops your car. This braking force, being a combination of two friction forces, is strengthened or weakened according to the strength or weakness of either one of the two contributing sources of friction. So your ability to stop your car depends on the amount of friction available from these two sources.

How Much Friction Is Available for Car Control?

The amount of friction available for the control of your automobile varies greatly with conditions. The chief factors which determine the amount you have when starting and stopping your car or maintaining traction are:

Condition of brakes
Condition of tires
Kind and condition of road surface

Since friction differs under varying conditions and surfaces, it is convenient to have some way of measuring and expressing the degree available at any time. This measure of friction between surfaces is called the *coefficient of friction,* and it is found, in the case of an automobile coming to a stop, by dividing the braking force by the weight of the car.

If, for example, the braking force is equal to 1,200 pounds and the weight of the car is 3,000 pounds, the coefficient of friction is the ratio between them, or 0.4.

This coefficient, or measure of braking effectiveness, is smaller when the road surface is slippery, the tires smooth, or the

brakes badly worn or maladjusted. If any such conditions reduce the effective braking force to 600 pounds and the weight of the car remains 3,000 pounds, the coefficient drops to only 0.2. If, on the other hand, the tires have good tread, the brakes are in good condition, and the road surface is dry and firm, the effective braking force may increase to 1,800 pounds, and the coefficient is then increased to 0.6. The driver then has more control of his car.

The driver's control of his car at any time depends on the coefficient of friction at that time.

The driver controls the degree of available friction only by keeping tires and brakes in first class condition, by applying brakes effectively, and by exerting whatever influence he has in seeing to it that road surfaces are properly engineered, built, and maintained.

Effect of Bumps and Hollows

At low speed on a smooth, level road, free from bumps and hollows, the average force pressing the tires against the road is equal to the weight of the car. But no road is perfectly smooth. At high speeds, even on the best roads built, the force pushing against the tires varies as the car moves along, and, on bumpy roads, tires are actually off the road surface an appreciable part of the time.

Pneumatic tires, springs, and shock absorbers are put on the cars to add to comfort, but they have a technical function as well. They make the pressure between tires and road more constant and this makes braking more effective.

Road contractors build roads as smooth as possible. But some variations in the surface always remain. On rough roads, such variations can have considerable effect on friction even at low speeds. On smooth roads, surface variations become important only when the speed is high.

If the pressure under the tires drops to half the weight of the car when the car goes over a bump, the resistance to sliding is only half as great. The driver's problem, then, of stopping the car, or of maintaining traction and holding the car on a steady course, is greatly increased. Many drivers

fail to realize that it can be just as necessary to reduce speed on a *bumpy dry* curve as on a *smooth, slippery* curve of equal sharpness.

Friction is a fundamental fact of nature, and every driver must understand and respect both its possibilities and its limitations if he wants to *control* his car.

TURNING ON A CURVE

Friction plays its part when your car is rounding a curve. But there is also another force at work. A body moving straight ahead tends to keep on moving in a straight line. It moves in a curved path only when some force pulls or pushes it out of a straight path. Whirl a rock above your head on the end of a string. At one end, the string pulls on the hand; at the other, it pulls with equal force on the rock. The string pulls just hard enough on the rock to overcome the force which tends to make the rock go in a straight line. This pull away from the center and toward a straight line is called *centrifugal force*—a force in nature with which every driver on a curve must deal.

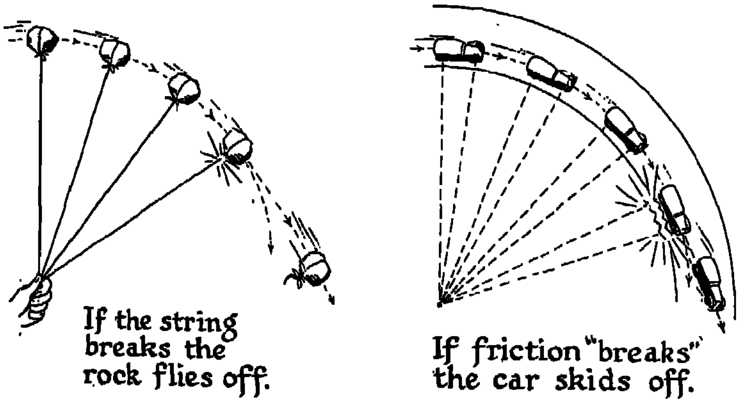


FIG. 98. Centrifugal force overcomes friction, and the car skids.

The force which makes an automobile round a curve is obviously initiated by steering. The interesting thing is that when you steer a car, you are merely controlling the direction

in which friction must work. At every point along the curve, the car is *tending* to go in a straight line. But the steered car is being constantly pushed out of straight-line motion by the force which friction permits to act under the tires. Friction does the same thing to the car that the string does to the stone—holds it in its curved path. The force which *counteracts* centrifugal force is applied by the road surface pushing on the tires and toward the inside of the curve. Without this friction or gripping between tires and road, centrifugal force would carry the car off the road.

But suppose that on a curve you hit a path of slippery roadway where friction is much reduced. Accurate steering becomes impossible; centrifugal force wins out; the car follows nature's law and leaves the curve to follow a straight path, just as the whirled rock does if the string suddenly breaks. The seriousness of the resulting accident depends on the speed at which the car was traveling when friction gave way and upon the chance set-up as to banks, ditches, trees, other vehicles, or pedestrians.

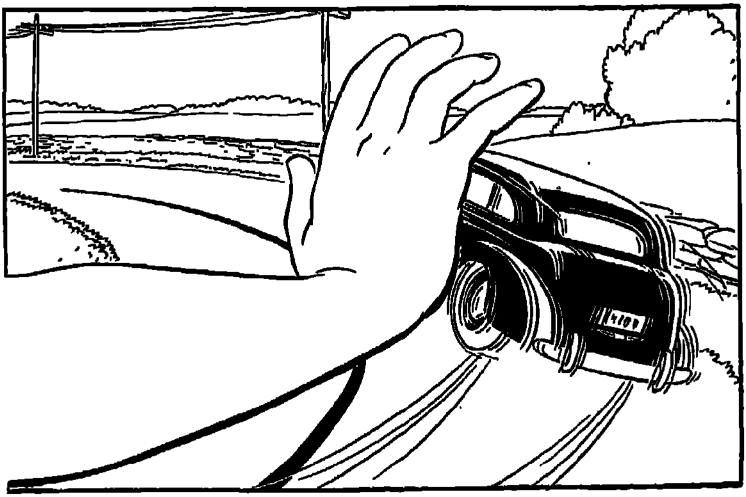


FIG. 99. You can't escape centrifugal force. But you can help manage it by keeping the speed of your car under control.

Available Road Friction on Curves

The driver's ability to make his car round a curve depends chiefly on:

Speed of the car
Slope of road surface
Sharpness of the curve
Road and tire conditions

Of the four, car speed is generally the most important, and it is the only one over which the driver has full control. You must take the road as you find it; you cannot control the radius of the curve on which you drive; you can, however, control your speed.

Speed—The faster the car is moving around a curve the greater the centrifugal force that is tending to pull it off the road. Here is an inescapable natural law. It is perfectly logical, then, that the speed, as your car rounds a curve, has to be kept well below the point at which centrifugal force would win out.

Safe speeds on curves are tied up inevitably with type of curve construction.

Curve Slope—To permit reasonable speeds on curves, forces tending to make the car take a curved path must be increased. How can this be done?

These forces depend to a considerable extent on the construction of the curve.

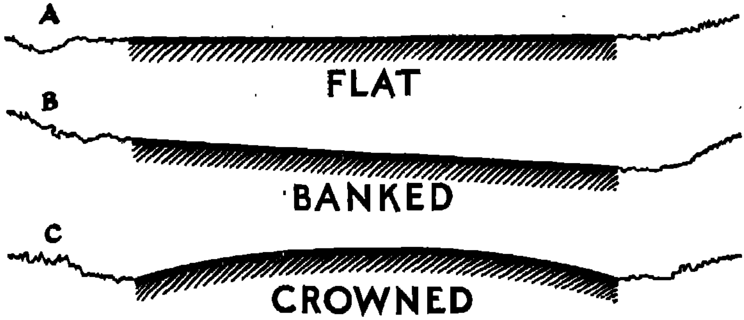


FIG. 100. Cross-sections of roads on curves.

Road surfaces on curves are principally of three kinds: (a) flat; (b) crowned; (c) banked. Imagine cutting straight across the roadway with a huge saw to make a road "cross-section." The three types of surface would then look to you somewhat like the cross-sections in Fig. 100.

On *flat* curves, the road-push toward the inside of the curve is lacking. Centrifugal force is not counteracted sufficiently and increases so much with increased speeds that you have difficulty holding your car on the curve.

On *crowned* roads, a car on the outside of the curve tends to slide down the crown and away from the center of the curve. The car weight then actually aids the centrifugal force which is pulling the car off the road. Only greatly reduced speeds will keep a car that is rounding a crowned curve on the road at all.

The *banked* curve is the best construction, because the slope of the bank pushes the car toward the center of the curve. This provides part of the force needed to overcome centrifugal force and helps keep the car on the curve.

Of course the friction force required for a car to round a curve increases greatly as speed increases, whether the curve is flat, crowned, or banked. But the increased degree of available friction on banked curves for overcoming centrifugal force makes the banked curve construction highly desirable. When the public understands the physical reason why banked curves are both more comfortable and safer, correctly banked curves will be demanded.

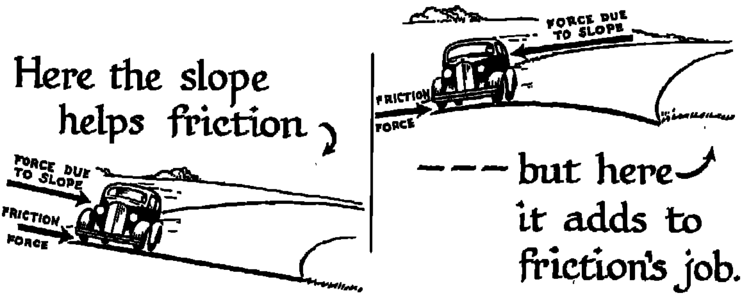


FIG. 101. The crowned vs. the banked curve.

Sharpness of Curves—As the radius of a curve is made shorter, the curve is made sharper. With a sharper curve, centrifugal force is increased. It follows, then, that:

1. It is very important for sharp curves to be banked to increase available friction.
2. Speeds must be reduced as curves are sharper.

It is sometimes difficult to sense the sharpness of curves on sight. However, it is valuable to grasp the principle of the effect of curvature on safe speeds. The driver who reduces his speed more and more as the curve is sharper and sharper, is simply showing an intelligent grasp of nature's laws. He is reducing centrifugal force.

Road and Tire Traction—The amount of force that can be developed under the tires of a car to resist sliding on a curve depends also on the slipperiness of the two surfaces in contact—the tires and the road.

If the curve is free from bumps and hollows, the tires have good tread, and the road surface is not slippery, the available road friction is good. Speed on curves must be considerably reduced, however, on bumpy, wet, or icy pavement, or when tires are smooth.

No exact directions for speed reductions on curves can be given, because conditions can be so varied. But if a speed of 40 miles per hour is reasonable for a certain dry curve, it is probable that speed should be reduced to at least 30 miles per hour when the same curve is wet, and to at least 10 miles per hour for icy conditions.

You cannot reduce speed *instantaneously*. If you enter a curve at too high a speed, you are likely to slide off the curve before you can bring your speed down. So it is very important to enter the curve at a speed that does not overtax your available amount of friction. Good drivers do not round curves with the car always on the verge of skidding. They allow a generous factor of safety.

KINETIC ENERGY AND CHANGING SPEED

Any moving body has stored energy of motion, or *kinetic energy*. This is true of a moving automobile.

This stored or kinetic energy is what keeps the car in motion when you depress the clutch fully.

The greater the speed of a moving object, the greater the stored or kinetic energy. In fact, *kinetic energy varies as the square of the speed*, which means that doubling the car's speed will quadruple the car's stored or kinetic energy.

Bringing the Car to a Stop

The important facts about kinetic energy to the driver are:

1. The only way you can stop a moving body is to use up its stored or kinetic energy.
2. The greater the car's speed, the more kinetic energy you must use up before you can stop it.

How can you use up the car's kinetic energy? If you use it up by merely *coasting* to a standstill, it passes away, little by little, in the form of heat caused by friction between moving parts, and through air resistance. But this method of using up kinetic energy takes too long for driving purposes. So you apply brakes to use up the moving car's kinetic energy quickly. Brakes change the kinetic energy to heat which can be felt on the brake bands.

When brakes are applied, there is a back push of the road against the tires. The car comes to rest only when this back push, or braking force, has used up the energy the car had before the brakes were applied. For this reason, stopping distance is mathematically related to (1) the speed of the car and (2) the coefficient of the braking friction.

If you are on a good, straight, dry road and step down hard on the brake pedal, you can develop a large braking force that will use up the kinetic energy and stop the car rapidly. If you put on the brake gently, the small braking force that is developed will take longer to use up the kinetic energy and bring the car to a stop. If the road is icy, it does not matter how hard you put on the brake, because you can develop only a little braking force, and it is impossible to stop the car quickly. In fact, on icy roads, you can develop only 1/10 the usual braking force, and the car travels ten times farther than on dry roads before coming to a stop.

The coefficient of friction between new tires and a good, clean, dry concrete surface may be as high as 0.80 or 0.90. Brakes properly adjusted and applied should keep the wheels just at the point of skidding. The wheels should not actually slide or skid, for if skidding takes place the braking force decreases.

Many car owners fail to keep their brakes in proper condition. Dirt, gravel, and other loose material on the road surface also lower the coefficient of friction. Because of such factors, actual braking forces available for use in average driving are often much less than 0.80 W or 0.90 W, ("W" standing for weight of the car). Table IX shows what might be called the average maximum braking forces for different road conditions when making an emergency stop.

BRAKE, ROAD, AND TIRE CONDITIONS	BRAKING FORCE
Hard, dry road, average tires and brakes	0.50 to 0.40 W
Wet road, average tires and brakes	0.25 to 0.15 W
Icy road, tires from average to poor condition, average brakes	0.10 to 0.05 W

TABLE IX

Reducing Speed by a Fixed Number of Miles Per Hour

Many an experienced driver does not realize that the *distance* his car travels while the speed is being reduced a certain number of miles per hour depends mainly on *what the speed was at the start.* Decreasing speed, as we have seen, means using up kinetic energy, and kinetic energy is proportional to the square of the speed.

The kinetic energy that must be disposed of when stopping your car bears such an inescapable mathematical relation to the speed of your car that, try as you may, a greater distance is required to slow down a given number of miles per hour at high speeds than at low speeds. Failure to realize this is one reason why some drivers enter curves at too high speeds and

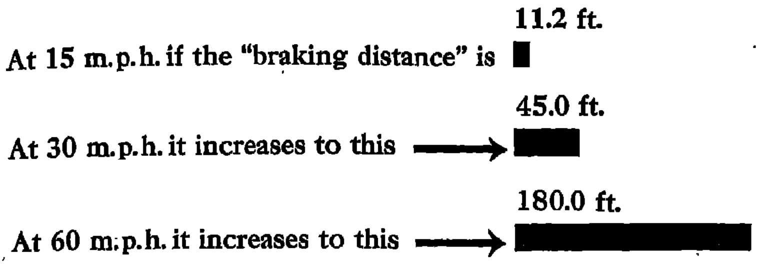


FIG. 102. Braking distance increases approximately *as the square of the speed.*

have to attempt what never should be done—to slow down *on the curve.*

Downhill Stopping

When a car is going downhill, the problem of stopping is further complicated. A car is slowed down by the *net force* holding it back. This net force is the braking force under the tires *minus* the force pulling the car down the hill because of the weight.

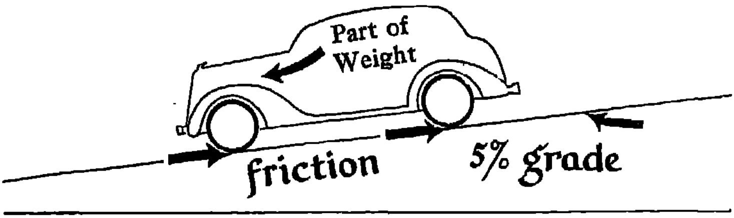


FIG. 103. Net stopping force equals braking force minus part of the weight of the car.

That is, the steeper the hill and the heavier the car, the greater the force that is pulling the car down hill.

Because of the gravitational pull down a hill due to the car's weight, you cannot stop so quickly, with the same braking force, on a hill as on the level. If you start down the hill at considerable speed, there is more kinetic energy to be used up, and so your braking force must act over a greater distance and your stopping distance is lengthened. It is just as important

to reduce speed at the top of a hill as it is to reduce speed when approaching a curve.

Here is another natural law from which there is no escape. *If your speed is kept constant, your danger zone automatically lengthens when you go over the crest of a hill.* You can keep your danger zone from lengthening, when going down a hill, *only* by decreasing speed according to the steepness of the hill.

Stopping on a hill depends, then, on the *net force:*

The possible back-pull—	Friction between tires and road surface Effectiveness of the brakes
minus	
The sure down-pull—	Steepness of grade Weight of car and its load

FORCE OF IMPACT

Another inescapable physical law is very much in evidence when cars collide. The *force of impact* in a collision cannot be softened by fear, ignorance, or regret.

You determine the force of impact when you determine your speed, for *force of impact varies as the square of the speed.*

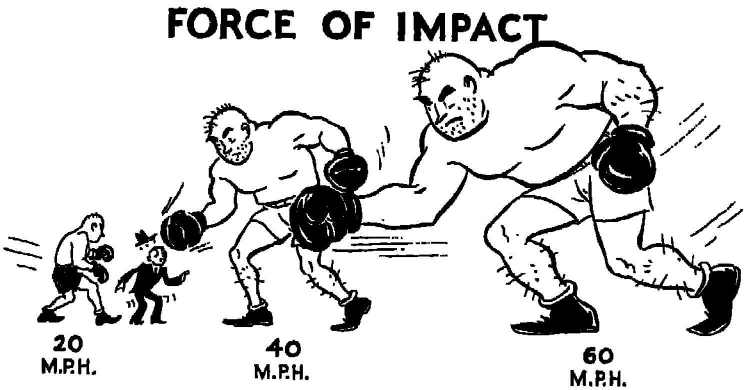


FIG. 104. Extra speed adds frightfully to the power of your car to do damage.

When you double your speed you increase, by *four* times, the striking force of your car. Triple your speed, and your car will inflict a blow *nine* times as great.

At 15 miles per hour, your car's force of impact in a collision with a solid fixed object will do as much damage as though it fell from a height of about 7½ feet. At 20 miles per hour, its damage would be the same as though it fell from a one-story building. At 40 miles per hour, the force of impact would equal that of a car falling 53.6 feet, or from a very high four-story building. If your car collided at 60 miles per hour, the force would equal a fall of 120 feet, or from a building about ten stories high. Potential force of impact piles up very quickly with increased speed.

No driver can afford to deal lightly with such potential forces of impact.

YOUR OWN NATURAL IMPULSES

Nature's laws pertain not only to the car. They apply also to the driver.

Many of the things you do are automatic. They are unconscious "reflex" actions beyond customary control. If something flies near your eyes, you close them automatically. If you slip on a banana peel, certain muscles automatically act in an effort to help you regain your balance. If you are driving an automobile, reflex actions of this sort may or may not prove favorable.

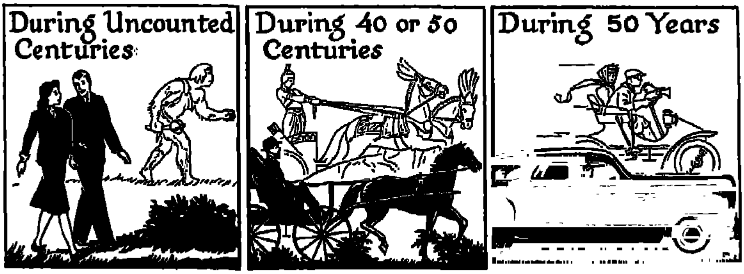


FIG. 105. The automobile is new to man. His habits rather than his reflexes can be adjusted to the new conditions.

Suppose your car hits a rough or icy spot in the road, and makes a sudden, unexpected lurch. There is likely to be an automatic down-thrust of your feet. Down goes your right foot on the gas pedal, and the car jumps forward. Your whole body tends to stiffen in an attempt to steady itself. Before your mind can break the chain of your automatic actions and take control again, the scene may be set for a serious accident. Reflexes are not all adapted to the automobile age. In many automobile accidents where it is reported that, "the car went out of control," actually, it was the driver.

With practice, driving habits can be made *almost* as strong as reflexes and can be substituted for them.

You have to guard against undesirable reflexes in emergencies. The best defense is close attention so that you are never caught unprepared.

DISCUSSION TOPICS

1. What is the effect of the "crown" of a road on a car traveling on the inside of a curve? The "outside"?
2. Compare the available friction when a car is rounding a flat-surfaced curve and when it is rounding a banked curve.
3. In what ways is a car endangered by mud which has been washed onto some part of a road pavement by a heavy storm? How should the driver meet this situation? On a straightaway? On a curve?
4. Why does a rapidly-moving car swerve if the wheels on one side run off the pavement onto a soft shoulder?

PROJECTS

1. To illustrate the tendency of a car to slide off the road on a curve, lay a bicycle on the ground so that a wheel is on a horizontal plane. The tire will represent a miniature circular roadway. Place a penny on the tire to represent a car on the road. Turn the wheel slowly, then faster, until centrifugal force slides the coin off the tire. To illustrate the effects of "banking" and "crowning," lay three coins on the tire a few inches apart. Lay one coin on the highest part of the tire; one in towards the axle so that it lies on the down-slope (outside of crown). Now rotate the wheel, starting slowly and speeding up, and note the order and relative speeds at which the coins slide off.

2. Find out what your state highway department has adopted as the maximum amount of banking per foot of width. List advantages and disadvantages of more banking than your state uses. Discuss with your city or state highway engineer.
3. Cut a block of wood with a square base and with a height 5 times its width. Stand this block on end on a level board laid on the floor of the car with one side parallel to the direction of car movement. By driving at various speeds on several curves, determine the maximum speed at which you can take each curve without upsetting the block. This maximum will give a safe and comfortable speed for each curve.
4. Cut out a piece of the tread of a discarded tire about four inches by six inches. Place a rock on this weighing about 5 lbs. to 10 lbs. Get the exact weight (W) on a scale. With a small spring scale (reading to 10 lbs.) pull this piece of tire steadily along the pavement, attaching one end of the scale to the piece of tire and pulling on the other end with the scale parallel to the road surface. You can easily find the coefficient of friction by dividing the pull on the scale by the total weight of the tire and rock. If the rock and tire weighed 8 lbs. and the pull were 5 lbs., then the coefficient would be 0.625. Find, by experiment, the coefficient of friction on various types of roads when wet, dry, and sanded. Try pulling uphill and downhill. If ice is available try the experiment on ice. What type of surface do you conclude is most dangerous? Which the least dangerous?
5. Devise a means of demonstrating graphically to a group, why the danger zone lengthens at a hillcrest; how much farther it takes to slow down from 60 m.p.h to 45 m.p.h. than from 30 m.p.h to 15 m.p.h.; why excessive speed is more serious on a curve than on a straightaway.

FOR FURTHER READING

Speed Regulation and Control on Rural Highways. Highway Research Board, Washington, D. C. 1940. 87 pp.

The Effect of Road Curvature and Speed on Safety of Automobile Operation. Roys, F. W. Proceedings, Institute of Traffic Engineers. Strathcona Hall, Yale University, New Haven, Conn. 1935. p. 87.

Houghton Lake Skidding and Traction Tests. Committee on Winter Driving Hazards, National Safety Council, Chicago, Illinois. 1946. 18 pp.

CHAPTER X

Traffic Laws Made by Man

Do You Know:

- **How our traffic laws came about and how changes are made?**
- **The basic rules of the road?**
- **What determines legal speeds?**
- **Legal restrictions on ownership and licensing?**
- **The traffic laws for pedestrians and bicycle drivers?**

LAWS DEVELOP FROM CUSTOM

MANY OF our fundamental traffic laws, such as driving to the right, developed from custom. If you ask elderly persons why they used to drive their horse-drawn wagons on the right side of the road, they will probably answer, "Why, that was the custom."

Such informal customs were later written down as laws, and the first fundamental highway regulations came into being. These regulations have been, and must remain, subject to revision in the light of changing traffic needs and conditions.

FIG. 106. Some "rules of the road" were adopted from custom long before the automobile made its appearance.

KEEPING LEGISLATION ABREAST OF THE TIMES

Every winter, after the last football scores have been posted and the "All-American Team" has been picked, noted coaches meet to discuss the rules and to adopt new ones. An individual

coach may disagree about a new rule but he must abide by it, for, in all competitive sports, rules must be uniform. Sound, standard rules protect players from dangerous practices and confusion and make for good sportsmanship and fairness.

Sound, uniform traffic rules are even more important. For the hazards of the highway are far greater than the hazards in sports.

In this motor age, with its rapidly changing conditions, society has the interesting responsibility of keeping traffic legislation abreast of needs.

Who Makes the Traffic Laws?

What units of government are responsible for making traffic laws?

The right of each state to control certain acts of the people within its boundaries is fundamental to our system of government. This right includes the power to determine who shall use the highways, and under what rules. That is, the state determines the legal responsibilities of drivers and pedestrians.

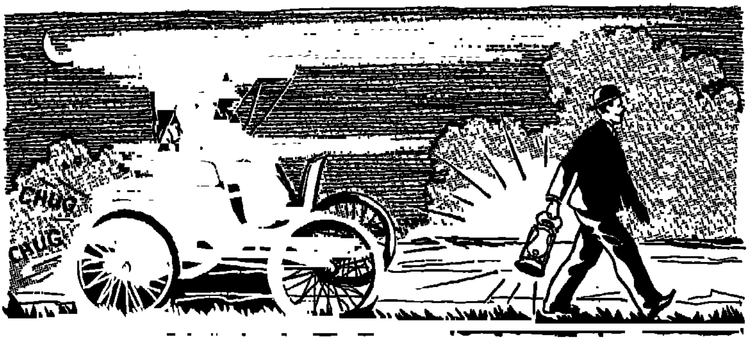


FIG. 107. An early regulation required that a man carrying a lantern walk ahead of the horseless carriage.

In the early days, the states saw no reason to enact traffic regulations, for the problems of traffic were mainly local in character. So local communities were given authority to control traffic.

Police handled the regulation of all kinds of traffic as part

of their duty to protect life, limb, and property. The coming of the motor car merely extended the supervision which the police had held over horse-drawn vehicles.

Each city did its best to meet new needs with new regulations. Naturally, officials of various cities differed about the best way of accomplishing their purposes. The result was a rather intricate web of local traffic regulations.

Gradually, as motor car use took on a less local character, states began to exercise their fundamental authority by enacting *state-wide laws* governing motor vehicles. The result was a frequent conflict between local and state regulations. In certain places, some of this conflict still exists.

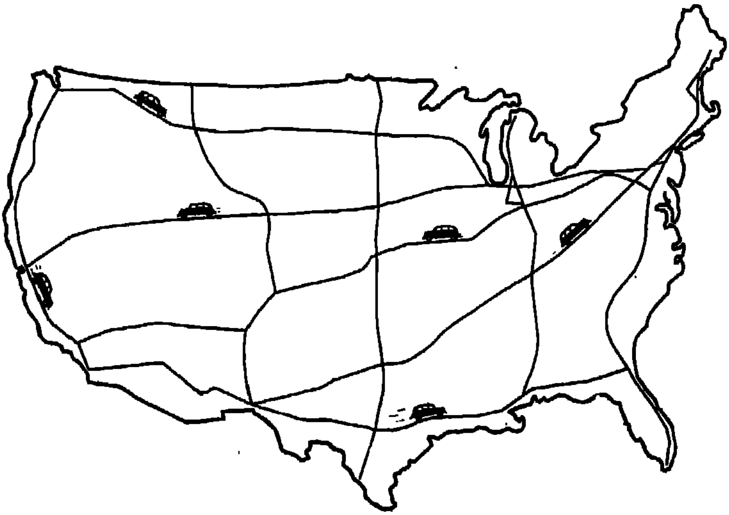


FIG. 108. Motorists know no state bounds; uniform rules of the road are necessary.

Formerly, when a motorist traveled through different states and cities and used the laws of his home community as a standard, he frequently violated local traffic regulations. For there was little, if any, uniformity in traffic laws. There were all sorts of rules, as well as signs and signals of every conceivable nature.

Motorists complained, and progressive leaders in government and business saw the need for *nation-wide uniformity* in the regulations, signs, signals, and markings which every motorist was expected to obey as he drove from city to city and from state to state. They also saw need for indicating just which motor regulations should be enacted by the state and which should be left to the municipality.

A Uniform Vehicle Code

National Conferences on Street and Highway Safety were held in Washington in 1924, 1926, 1930, 1934, 1938 and 1944.

Courtesy NEA Service, Inc.

FIG. 109. Only uniform traffic laws will end the confusion!

Interest centered in *model* traffic legislation for the states to adopt, and the Uniform Vehicle Code resulted in 1926.

A Model Traffic Ordinance for municipalities was also developed in 1928. To cover the need completely, a manual of standards for traffic signs, signals, markings, and islands was also prepared.

In the numerous states where those parts of Act V of the Uniform Vehicle Code dealing with Rules of the Road have been adopted, the state acts generally supplant all local driving rules. In such cases, all motorists in the state enjoy uniform rules governing such matters as speed limits on the open road, methods of turning, meanings of traffic signals, right-of-way, and pedestrians' rights and duties.

There was left to the municipality, however, the right to handle such *local* matters as parking and one-way street regulations, both of which needed to be designed to meet local conditions. Many cities have adopted ordinances in substantial accord with the Model Traffic Ordinance prepared by the National Conferences. Has your city stepped into line?

Federal Regulation

Traffic control, as we have already seen, is essentially a function of the states. The federal government, however, is directly concerned with the operation of motor trucks which transport property, and motor buses which carry passengers in *interstate* commerce.

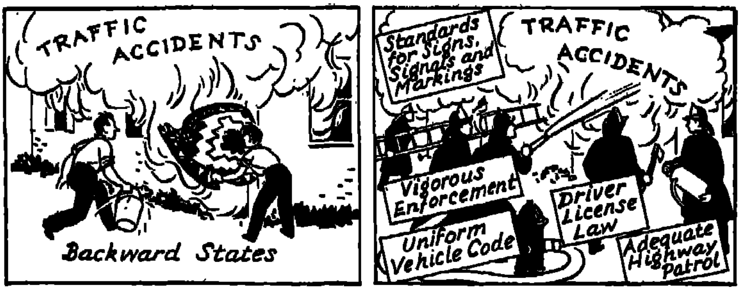


FIG. 110. You can't extinguish a serious fire with buckets and blankets! When modern methods are used, dangerous fires are quickly controlled.

In 1935, Congress passed the Motor Carrier Act, which gave the Interstate Commerce Commission power to regulate rates and service involved in *interstate* transportation of passengers and property on the highway. Under this authority, the Commission has established regulations on qualifications and maximum hours of continuous service of drivers of trucks and buses. It has also established standards concerning equipment, operation, and reports of accidents. Initial regulations became effective in 1937, and others have been added from time to time. They now apply to all "for hire" carriers of passengers and property in *interstate* and foreign commerce and to all *private* carriers of property.

In addition, the federal government has important responsibilities concerning the facilitation of movement, across state lines, of army vehicles in military maneuvers, in convoy, and in other defense movements.

Looking to the Future

While there has been steady progress in recent years toward nation-wide adoption of the Uniform Vehicle Code, the Model Traffic Ordinance, and standards for traffic signs, signals, markings, and islands, much remains to be done.

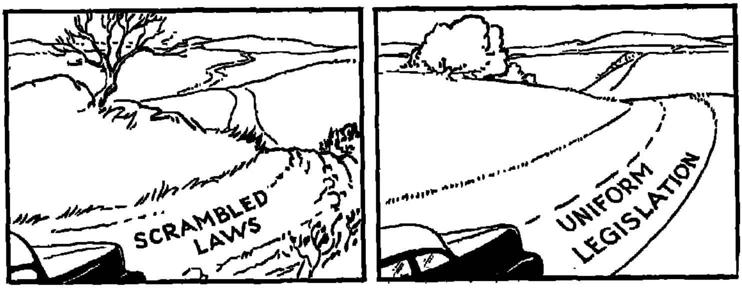


FIG. 111. What a difference in both safety and pleasure!

The public must be taught to accept and obey traffic laws, and to demand standard signs and traffic control devices. Society will look to the new generation of drivers trained in

sportsmanlike driving for many such answers to its traffic problems.

A DRIVER'S LEGAL RESPONSIBILITIES IN TRAFFIC

In considering specific traffic regulations, you must always bear in mind that state traffic laws still differ considerably. SPORTSMANLIKE DRIVING describes regulations which are in effect in those states that have enacted provisions similar to the Uniform Vehicle Code. In each case, check the provisions with your own state's law. If regulations in your state differ from those described in SPORTSMANLIKE DRIVING, you must, of course, be governed by your own present state law. But you should be interested in working for changes that will bring your state in line with the Uniform Vehicle Code.

Rules of the Road

Fortunately most states have prepared a digest of the ordinary rules of the road written in simple, non-legal style and well illustrated.

The provisions generally covered in state vehicle codes deal with speed requirements; meaning of traffic control signals; driving after drinking intoxicants; right-of-way regulations; pedestrian rights and duties; overtaking and passing; giving hand signals; passing street cars; stopping, standing, and parking; condition of brakes, lights, horn, mirror, windshield wiper, and other safety equipment; limits of size, weight, and load of vehicles; driver licensing, ownership, and liability.

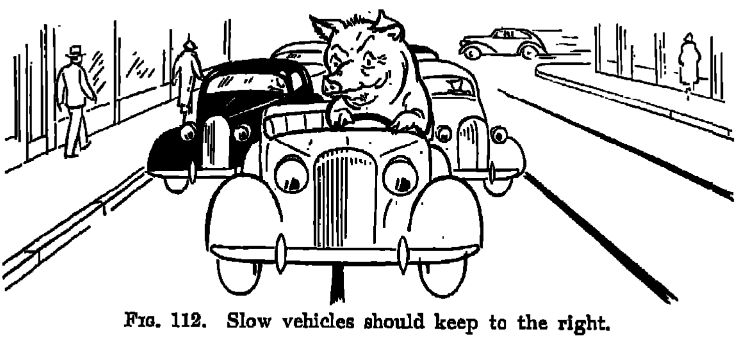


FIG. 112. Slow vehicles should keep to the right.

Without such rules, use of the highways by great numbers of persons at a time would inevitably result in trouble. Rules of the road keep order in the traffic pattern.

Here are some of the fundamental rules of the road:

1. Drive to the right of the road center.
2. In overtaking a vehicle, pass it on the left.
3. In meeting a vehicle coming from the opposite direction, pass it on your right.
4. Allow overtaking vehicles to pass.
5. If driving slowly, keep to the right.
6. Signal intentions to slow down, stop, or turn.
7. Always drive at a speed that is reasonable and prudent under existing conditions.

FIG. 118. Even at sea there are "rules of the road."

A number of the rules of the road named above are so basic that we scarcely think of them as *laws*. A few of them are so universally observed that it is exceptional to hear of a violation.

Frequently, exceptions to a general rule are warranted. These exceptions are stated in the law itself, or the traffic authority definitely indicates them by an appropriate sign, signal, or road marking.

Any direction given by an official sign, signal, road marking, or traffic officer takes precedence over the customary rules of the road, but where there is no special direction, the rules of the road are the proper guides.

Right-of-way Rules

In general, right-of-way rules indicate *who shall yield* when there is a conflict between vehicles, or between a vehicle and a pedestrian. In other words, such rules establish traffic priority.

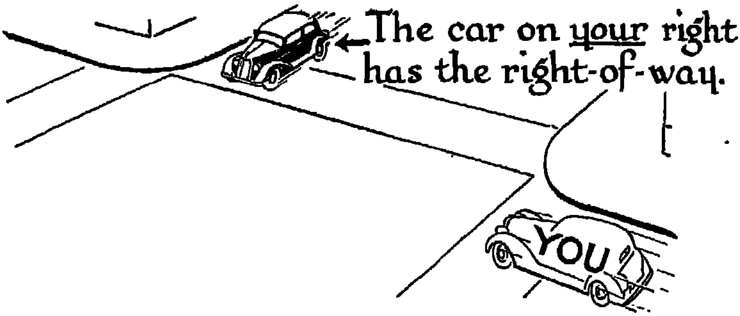


FIG. 114. The car marked "YOU" must *yield* the right-of-way when it's a "tie."

When the driver of an emergency vehicle, for instance, warns of his approach with a siren or other special signal, he has immediate priority, and it is the duty of all other drivers to yield the right-of-way. They must move over close to the curb, get out of the intersection, or otherwise clear the way for the emergency vehicle.

Here are some right-of-way rules:

1. The driver of a vehicle *approaching* an intersection shall yield the right-of-way to a vehicle which has entered the intersection from another highway.
2. If two vehicles reach an uncontrolled intersection at the same time, the vehicle on the left must yield the right-of-way to the vehicle on the right.
3. Drivers must yield the right-of-way to pedestrians crossing at intersections, in accordance with regulations.
4. The driver of a vehicle within an intersection and intending to turn left must yield the right-of-way to vehicles approaching from the opposite direction and within the

intersection, or so close to it as to constitute an immediate hazard.

5. A vehicle emerging from a private driveway, or a secondary road, shall yield the right-of-way to vehicles on the main highway.

It might be thought that right-of-way means the right to *immediate use* of the roadway. But it isn't quite that simple.

The right-of-way is a right you can use *only as long as it does not conflict with a more basic legal right or personal obligation.*

When legal rights clash, the more fundamental right must be given preference. It is a fundamental duty of everyone so to use the highway as not to cause accidents. This duty is more fundamental than any right-of-way rule.

There are various situations in which one should not assert his "rights." The driver of the vehicle on the right is not given the right to proceed *under all circumstances.* The implication is that the right-of-way is his, but he must use good judgment as to where he claims it.

Suppose, for example, that an elderly lady starts across the street on a red light. You are approaching on a green light. Your right-of-way does not let you go honking and swerving past her.

Or, when the green light gives the driver permission to turn right, it also gives the pedestrian the right to cross. Here

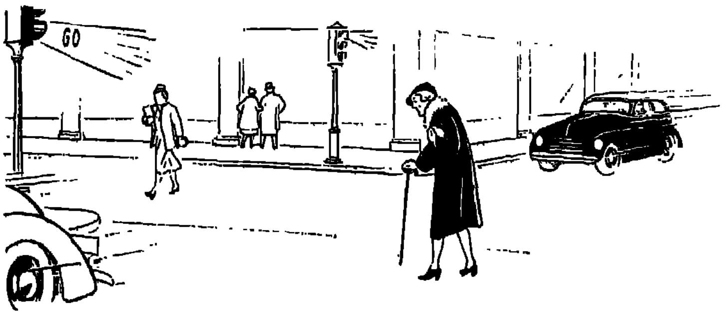


FIG. 115. It is the driver's duty to avoid accidents even though pedestrians disregard traffic ordinances.

is a conflict of rights-of-way. In this instance, *the law specifically provides that the driver shall yield the right-of-way to the pedestrian.*

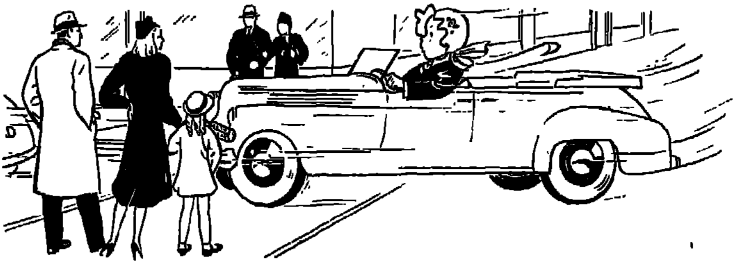


FIG. 116. The driver shows childish characteristics when he blows his horn and brushes past pedestrians without regard for their safety.

Suppose a car is sliding down a hill, entirely out of control, with a red light against it. You are entering from the cross street at the right of the sliding car and the light is green in your favor. You would be absurd to claim a right-of-way.

The driver who fails to yield his right-of-way in an emergency situation is flirting with the same sad fate as Mr. Gray—

"Here lies the body of Julian Gray
Who died while taking the right-of-way.
He was right, dead right, as he sped along,
But he's just as dead as if he'd been wrong."

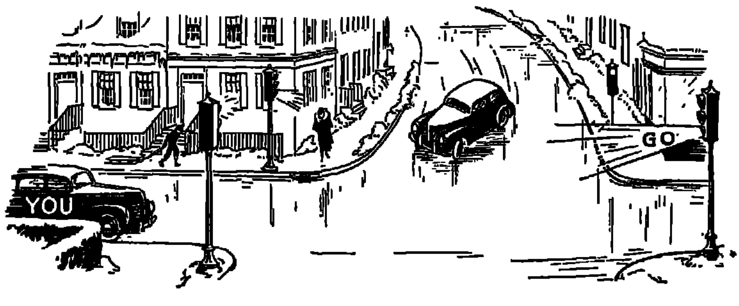


FIG. 117. An icy hill; a car sliding rapidly into the intersection on a red light. Would you insist on your right-of-way?

Last Clear Chance

Fixing blame for an accident involves, not only the right-of-way, but another fundamental traffic principle—the doctrine of the *last clear chance.*

Lying in the hospital wrapped in bandages, you might take some small comfort in knowing that you had the right-of-way and that it was the other driver's mistake that put you there. But to have "dodged" the accident entirely would surely have been better.

As the driver of an automobile, you are obligated to do what you can to protect another driver even from his own mistakes. No matter how foolish or illegal his actions may be, you have no right to let his actions result in an accident if you have the last clear chance to prevent it.

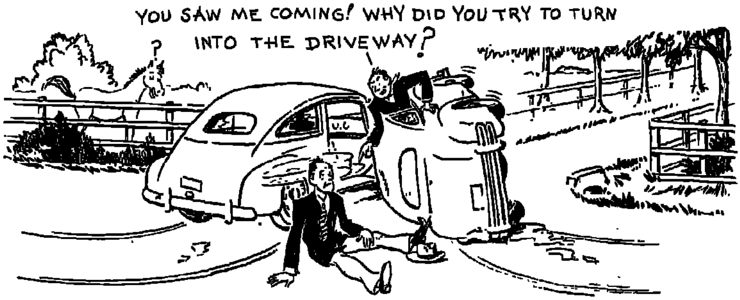


Fig. 118. There's little comfort in knowing that it was the other driver's mistake.

This may not seem reasonable at times, but it is a principle which may be invoked in court.

If the driver chooses deliberately to run through a red light while you are entering an intersection, you still have the duty to do all you can to prevent his action from causing an accident. When a collision occurs, *it is the fault of the person who had the "last clear chance" to avoid it.* Tom, Dick, or Harry may do something wrong, but if *you* still have a reasonable chance to avoid a collision and fail to use that chance, the court may hold you at fault.

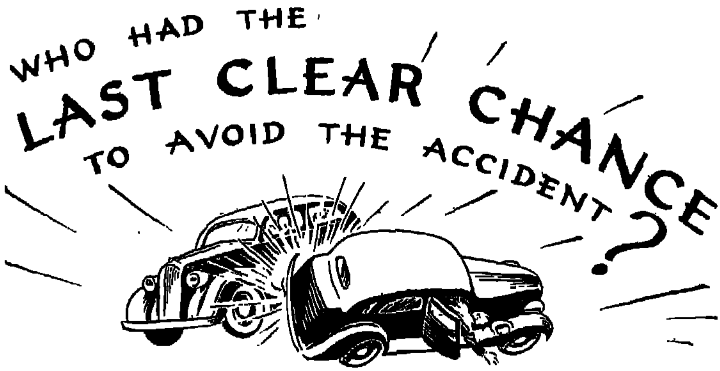


FIG. 119. Where will the blame be placed?

When it comes to safeguarding pedestrians, the motorist is subject, not only to this doctrine of the last clear chance, but to an additional principle. *The person who has the power to inflict injury also has a special responsibility to avoid inflicting it.*

It is the motorist who can hurt the pedestrian. Therefore, the motorist must safeguard the pedestrian even from the consequences of the pedestrian's most foolish acts.

Furthermore, even a pedestrian with physical or mental defects has the right to use the streets. His defects may not be apparent to an approaching motorist. So the question in the mind of the motorist, as he approaches any pedestrian, ought to be, "Is this person deaf or half blind?" How can the driver know? He may hold the last clear chance to avoid an accident, and he should drive in accordance with that possibility.

Speed Control

On perhaps no other traffic subject is there so much disagreement in point of view and in legislation as there is on numerical limits for driving speeds.

There is general agreement on what is known as the *basic rule on speed.* This rule requires persons *never to exceed a speed which is reasonable and prudent for existing conditions.*

The basic rule provides that speed shall be so controlled as to avoid collisions with any pedestrian, vehicle, or other conveyance using the highway legally and exercising due care.

Disagreements on speed limits come about through efforts to set maximum rates of speed for various places and conditions.

The problem of specific speed limits is a difficult one. What maximum speed limit, for example, would you advise in front of your school? You know that safe speed varies with numerous factors, such as reaction time, driver condition, brake efficiency, condition of pavement, weather condition, and the whole traffic set-up of the moment. A speed which is reasonable when there are few persons or vehicles about will be excessive in heavy traffic, or at hours when school children must cross the roadway. Safe speeds, at certain times, over any stretch of roadway, are not safe speeds at other times.

The problem of stating safe speeds is so difficult that over one-quarter of the states have no maximum, open-highway speed limit but depend solely on the basic speed rule. Other states set a maximum open road speed limit, believing that many drivers cannot judge what maximum speed the basic rule imposes.

One-third of the states specify a "fixed" maximum speed which it is always illegal to exceed. Another third of the states specify a *prima facie* speed limit for the open road. Under a stated maximum limit, *you* must prove to the court that you were nevertheless not breaking the basic rule. If, on the other hand, an officer arrests you when you are driving at a speed lower than the *prima facie* limit, *the state* must prove that you were nevertheless violating the basic speed rule—as, for example, driving at an unreasonable speed on an icy road. The *prima facie* rule introduces some flexibility into speed limits, and so it is favored by many traffic specialists.

When fixed speed limits are used, legislators tend to set high maximum limits. The trouble then is that certain drivers conclude that it is all right to drive at the maximum speed, regardless of circumstances. Many police prefer the fixed

maximum limit because it is more definite and therefore simpler to understand and enforce. Only a few states have fixed limits below 50 miles per hour, whereas only a few *prima facie* limits are as high as 50.

Recently two types of speed regulation have been gaining favor. One specifies a lower maximum speed at night. The other permits "speed zoning" under which the proper state authorities make careful studies of maximum reasonable speeds, *under normal, fair-weather, daytime conditions*, for certain stretches of highway, and then post signs indicating the maximum for each "zone." These zoned speeds are generally fixed limits, if the state uses fixed limits, and *prima facie* limits, if such are used generally by the state.

Generally, speed limits are specified by state law or local ordinance for residential and business districts also, and often for curves, intersections, and school zones. Even the states which rely entirely on the basic rule for the open highway either specify limits, in at least some such locations, or permit local ordinances to apply. Such limits vary considerably but are naturally much lower than open-road limits.

Speed legislation is clearly a problem of greatest importance as well as of greatest difficulty. Much of the material in SPORTSMANLIKE DRIVING is designed to help you follow the basic speed rule—*never exceed a speed which is reasonable and prudent for existing conditions.*

Responsibilities in Case of Accident

Any accident situation discloses your personality, character, and sense of social responsibility. It imposes definite, clear-cut obligations on everyone involved.

Your first obligation in an accident is to "stand by." Running away from an accident is as cowardly a thing as one can do, especially if someone has been injured. The hit-and-run driver is held in the lowest possible esteem by his fellow men, for he proves himself without honor and without humanity.

A driver's obligations, when involved in an accident, are both moral and legal. The absolute minimum that he should do is:

Stop immediately
Render assistance
Obtain medical help if needed
Call an ambulance if one is required
Give his name, address, and license number
Remain at the scene of the accident until he is sure no further help is needed
Make an accident report promptly, both to the police and to his insurance representative

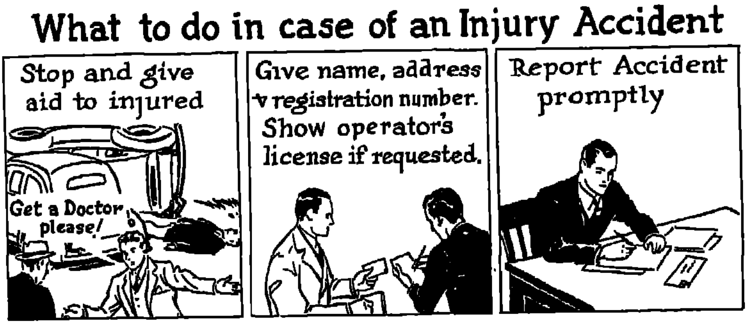


FIG. 120. Only unsportsmanlike drivers fail to comply with these requirements.

Use extreme care in rendering assistance to injured persons. Wanting to help the injured is a natural impulse. But Red Cross first aid experts warn that good intentions are not enough. Exact knowledge and skill are needed. Unskilled handling, particularly where there are broken bones, can easily increase the injury and even cause death. Avoid hurried moving of an injured person or bundling him into a passing automobile to rush him pell-mell to the hospital. Unless you have completed a standard first aid course and know exactly what is safe to do to an injured person, confine your first aid to keeping the victim warm and controlling any severe bleeding.

Every automobile driver should have systematic training in emergency first aid. Immediate, intelligent help can often save a life or make the doctor's subsequent care more effective. A first-aid kit carried in your car is very much worth-while if it is

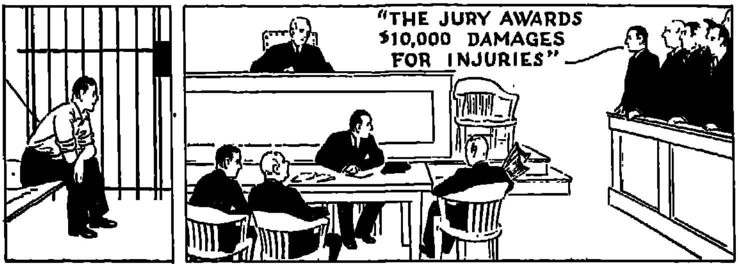
in the hands of someone who knows how to use its contents. Red Cross courses in first aid afford an excellent opportunity for this type of training.

An accident can result in two separate kinds of court cases, one the "criminal" case relating to the violation of a law, the other a "civil" case involving a suit brought by the "injured" party for money damages.

The law lays down certain rules which make the owner liable, within stated limits, if someone else has an accident while using his car with his expressed or implied permission.

In a majority of states, a non-paying guest, riding in a car which crashes, cannot recover damages unless it can be proved that the driver was intoxicated or guilty of willful misconduct.

TWO RESULTS OF CAUSING A CRASH



AND LATER

FIG. 121. Both criminal and civil court action may result from a crash.

LAWS CONCERNING OWNERSHIP, LICENSING, AND LIABILITY

1. Vehicle Registration

When you purchase a car, you must meet certain requirements before you can drive it. You must show proof of ownership, obtain your certificate of title, and be issued license tags or plates.

When a new car is purchased, a bill of sale must be signed by the dealer and registered with the proper state authorities. The state retains this bill of sale, and issues, in its place, a

certificate of title, which is a document describing the car and indicating its owner.

This certificate should be carefully guarded, because, when you want to sell your car, you must endorse the certificate and give it to the new owner. Otherwise, the new owner could not secure *his* proof of ownership, or certificate of title, from the state.

If you buy a used car, how can you know it is not a stolen car? If it proves to be a stolen car, the rightful owner may regain possession by means of his certificate of title and you will lose both the car and the money you paid for it. The receipt of a *bona fide* certificate of title with the car assures you that you are not purchasing a stolen car.

Even so, you must be wary and *be sure that you are not getting an altered or forged certificate of title.* Deal only with reputable persons, and be suspicious of any "exceptional bargain" that an unknown person offers you in a great hurry. Make sure also that there is no mortgage or lien on the car. If there is, and the person selling the car fails to pay this mortgage, you become liable and must make good the amount of the mortgage or lose possession of the car.

Certificates of title are of great value to the individual and to the state. When a car is stolen, the thief does not secure the certificate of title unless the owner has been foolish enough to leave it in the car. Stealing cars for the purpose of profiting from their sale is discouraged by title regulations. In fact, states which have adopted certificate of title laws show declines in the number of car thefts.

Registration tags protect an owner. Police in radio-equipped cars detect stolen automobiles through registration numbers. Your tags can also prove of unexpected value. For example, a certain business man, on a vacation tour, was once located by means of registration tags, and the result was a saving to his business of $25,000.

2. Operator's License

Even if you have your certificate of title and registration tags for a car, it is necessary to get permission from the state

before you may drive it on a public highway. The License Bureau clerk gives you an application blank to fill out and return with a required fee. As a "learner" you receive from the state a conditional permit allowing you to drive for 60 days, provided a licensed driver is in the seat beside you. A notice accompanying the permit informs you that you should present yourself, before the expiration date, to a state examiner for your license examination. If you need more time to prepare for the examination you must renew your learner's permit before the expiration date.

Here you have to demonstrate that you can drive satisfactorily. The inspector has you do such things as stop, turn around, make turns at intersections, and stop and start properly on an upgrade. He notes how well you obey various signs, signals, and markings. Your eyes are tested. You are asked a number of practical questions based on the state Vehicle Code. You are told that you should always carry your license card with you and that it is your duty to show your license upon request of the police or of a representative of the motor vehicle department. Whenever you change your address, you must notify the proper state office.

This license test provides a "weeding out" process to keep off the road those who cannot drive properly, those who are physically or mentally incompetent, those without proper knowledge of traffic rules, and those who show wrong attitudes.

The future will undoubtedly bring more attention to the qualifications of drivers. The social consequences of automobile driving are so important that the ability of the driver and the condition of his car cease to be merely matters of individual and private concern. They are a concern of society.

Contrast the best driver-licensing procedure in use today with the licensing requirements of a locomotive engineer or an airplane pilot. Is society too liberal in granting the right to operate a car and in permitting certain drivers to continue to drive? Has more weight been given to the keen desire of the individual to operate a motor vehicle than to the welfare and safety of the public at large?

There should be a more searching examination of new applicants. Already there is a trend toward the *re-examination of licensed drivers*—especially of accident-prone drivers, violation-repeaters, and the aged. Whether we like it or not, society will undoubtedly become more strict in the granting and withholding of the driving privilege.

FIG. 122. Note how effectively this driver is "ruled off the road."

If a driver is convicted for any of the following serious types of offenses, the laws of some states now make it *mandatory* that his license be revoked:

1. Manslaughter by automobile.
2. Driving under the influence of intoxicating liquor or a narcotic.
3. Operating a motor vehicle in the commission of a major crime.
4. Failure to stop and render aid when involved in an accident resulting in personal injury or death of another, or failure to report an accident as required by law.
5. Making false statements under oath involving any law relating to the ownership or operation of motor vehicles.
6. Three charges of reckless driving committed within a period of twelve months.
7. Operating a motor vehicle without permission of the owner or custodian.

3. Financial Responsibility

The Supreme Court of the United States has recognized the power of the states to enact safety-responsibility legislation. A majority of the states have enacted legislation requiring a driver, under certain conditions, to prove his financial responsibility.

Under safety-responsibility legislation, a driver can have his operator's license and registration certificates suspended:

1. If he has had a criminal conviction against him for certain serious violations of motor vehicle laws.
2. If, for more than 60 days, he has failed to pay a civil judgment against him for causing a motor vehicle accident.
3. If he is involved in a motor accident resulting in death, or personal injury, or property damage exceeding $50.

Such a driver must prove to society, before he is permitted to drive a car again, that he is able to take care of the costs of any future accident in which he may become involved. He can give satisfactory proof of future financial responsibility by taking out a suitable insurance policy, by providing a proper bond, or by depositing money or securities of stated value with the proper state department.

Such protective legislation, in states where it has been enacted, has been of great value to motorists and pedestrians by:

Influencing motorists to make themselves financially responsible.

Compelling payment of judgments for damages.

Requiring proof of financial responsibility of motorists found guilty of recklessness.

TRAFFIC REGULATIONS CONCERNING PEDESTRIANS

Two out of every five persons killed in traffic are pedestrians. In cities, often two-thirds or more of the traffic fatalities involve persons afoot. Man-made traffic laws must help protect them.

Where the careless acts of pedestrians are clear violations of law, the offenders can be taken into courts and fined. But, in many places, the laws regarding sound pedestrian practices

are so inadequate that they do not provide a proper basis for protecting and controlling the pedestrian. There is a growing opinion that specific regulations must be set up to control pedestrian practices and to protect the man afoot. Model regulations relating to the pedestrian are embodied in Act V of the Uniform Vehicle Code.

These regulations are designed to provide a reasonable cooperation in street and highway use between drivers and pedestrians. More and more cities and states are adopting regulations to:

Require pedestrians to obey traffic signals.

Grant pedestrians the right-of-way (a) at unsignalized intersections, and (b) at signalized intersections when crossing on the proper signal.

Provide that, if a green turn arrow signal is used, drivers shall yield the right-of-way to pedestrians lawfully crossing.

Provide for a pedestrian WALK signal and grant the right-of-way to pedestrians crossing on this signal.

Provide that vehicles shall not proceed OR TURN on a red signal if this interferes with or endangers pedestrians.

Require pedestrians to yield the right-of-way to vehicles when crossing at other than a crosswalk.

Prohibit pedestrians from crossing other than at a crosswalk when adjacent intersections have traffic signals in operation.

Provide that, whenever practicable, pedestrians shall use the right half of crosswalks.

Prohibit standing in a roadway to solicit a ride.

Prohibit parking within 20 feet of a crosswalk, to help pedestrians and drivers see each other sooner.

Uniform pedestrian regulations are needed. They would be more easily enforced, and they would foster good pedestrian habits.

Sound pedestrian practices, as well as sound driving practices, are largely a matter of habit formation. The more uniform the regulations, the safer the pedestrian and the driver

will be. When a different set of regulations is imposed on drivers and pedestrians by each different locality, habit systems are interfered with.

TRAFFIC REGULATIONS FOR BICYCLE DRIVERS

Bicycling has increased greatly in the past few years. It has grown to such proportions that recently a national committee developed new model bicycle regulations for adoption by municipalities. Some of the main regulations are:

A bicycle license and a license plate are required. Licenses will be granted only if the bicycle is found in safe mechanical condition through official inspection.

Bicyclists using the roadway are subject to traffic laws.

Bicyclists shall ride on the regular seat and a bicycle shall carry no more persons than the number for which it is designed and equipped.

Bicyclists shall drive as near the right side of the roadway as is practicable.

Hitching to vehicles or street cars is prohibited.

Not more than two bicyclists shall drive abreast on the roadway.

No bicyclist shall carry anything which prevents him from keeping both hands on the handlebars. (An alternate regulation permits carrying if one hand can be kept on the handlebars.)

Parking of bicycles must be against the curb, in a sidewalk rack, against a building, or at the curb, if on the sidewalk.

If a bicycling path is furnished, the bicyclist must use it and not the roadway.

Bicycling on the sidewalk is prohibited in business districts, and proper authority is given the right to post signs prohibiting bicycling on any sidewalk or roadway. (Alternate —No person of fifteen or more years of age shall drive a bicycle on any sidewalk.)

Whenever a bicyclist uses a sidewalk, he shall yield right-of-way to pedestrians and shall give audible signal before overtaking and passing pedestrians.

Bicycles used at night must have an effective light on the front and a good red reflector on the back. A red light may supplement the rear reflector.

Bicycles must be equipped with a suitable bell or other signal device, but must not have a siren or whistle.

Brakes must be capable of causing the wheel to skid on dry, level, clean pavement.

Many of the above regulations for municipalities are equally suitable for inclusion in state motor vehicle laws. Many municipalities and some states are adopting bicycling regulations. Obviously uniform bicycling regulations will benefit both bicyclists and motorists by reducing traffic delay, confusion, and accidents.

SOCIETY'S OBJECTIVES

To get an over-all picture of what society is trying to do to regulate traffic, consider society's principal objectives. Society is attempting to build up a traffic code that will produce:

1. Orderly, efficient, and safe use of streets and highways by all users.
2. A system of easily understood and enforced guiding rules of the road.
3. Uniformity in traffic practices.
4. Proper licensing requirements for drivers.
5. Proper safety equipment on vehicles.
6. Sound maintenance of safety equipment.
7. Protection of rightful car ownership.
8. Guides for damage suits arising out of accidents.
9. Proper designation of the rights, powers, and duties of various officials.
10. Revenue for highway and traffic purposes.

Are these objectives of society being satisfactorily met by the traffic laws made by man?

DISCUSSION TOPICS

1. Why is the privilege of driving granted *by the state?*
2. What changes in your community might require new traffic regulations?

3. Should all traffic regulations within a state be uniform? Justify your answer.
4. Why have traffic regulations not been made uniform by Federal laws?
5. What is meant by "reciprocity" as the term is applied to state laws affecting traffic?
6. If your state has not adopted important provisions of the Uniform Vehicle Code, what can your group do to secure their adoption?
7. Debate: The Uniform Vehicle Code for traffic regulation conflicts with our American Policy of States' rights.
8. There are some who believe that a left-hand right-of-way rule would be preferable to the right-hand rule when two vehicles approach an intersection at the same time. Discuss the advantages and disadvantages of the two types. Discuss also what would be involved in changing over.
9. Study the various right-of-way rules stated in this chapter. Are there too many? Can you suggest satisfactory simplifications?
10. What legal provisions do you think should control the drinking driver? The hit-and-run driver? The persistent violator?
11. What do you think should be the minimum legal driving age? Discuss this with a traffic police official, a judge, or a traffic engineer. Justify your opinions.
12. Describe the procedure necessary in your state to secure an operator's license.
13. Give illustrations of cooperative and non-cooperative practices in the use of streets by (a) pedestrians; (b) bicyclists; (c) motorists. What legalized uniform traffic practices would prove of common value to all of them?

PROJECTS

1. Find some specific provisions of the traffic law in your state that are designed to meet each of the objectives set up in this chapter (p. 169).
2. Obtain a copy of the Uniform Act Regulating Traffic on Highways. Study its provisions in regard to (a) speed, (b) hand signals, (c) other rules of the road.
3. Examine your own state motor vehicle code. See to what extent it conforms to the standards set up in the Uniform Vehicle Code. Make a list of changes which you think should be made in your state's traffic laws to bring about greater uniformity. Discuss this with your group. Send the proposals agreed upon to your motor vehicle administrator and ask him what your group can do to help secure such changes.

4. Secure a copy of the regulations in force concerning speed in your own and neighboring states. Find the number of arrests for speeding in each of these states. Just what constitutes the measuring stick as to when a person is speeding? What are your conclusions?
5. Secure a copy of the traffic ordinance of your city. Compare it with the state provisions about pedestrians. Are its provisions with respect to pedestrians wise? Adequate? Too severe? What changes or additions do you believe are warranted?
6. Dramatize the scene of an automobile crash to bring out what you should do when involved in a crash, whether you are to blame or not.
7. Examine critically all tests given license applicants in your state. Are they sufficiently severe? Explain. Make a list of the tests that you think should be used in determining the fitness of a person applying for an operator's license.
8. From a lawyer or judge, secure descriptions of two or three accidents in which the principle of the "last clear chance" was involved. Explain how it is applied in these cases.

FOR FURTHER READING

Digest of Motor Laws. American Automobile Association, Washington, D. C. Annual Publication.

Local Traffic Regulations. Local Traffic and Police Departments.

Manual on Uniform Traffic Control Devices for Streets and Highways. National Conference on Street and Highway Safety, Washington, D. C. 1937. (Revised Fall, 1938). 166 pp.

Model Traffic Ordinance. U. S. Public Roads Administration, Washington, D. C. 1946. 34 pp.

Motor Carrier Safety Regulations of the Interstate Commerce Commission. Bureau of Motor Carriers, Interstate Commerce Commission, Washington, D. C. Revised Edition, 1939. 99 pp.

Procedure for the Minimum Standard Examination for Drivers. American Association of Motor Vehicle Administrators, Washington, D. C. 1939. 22 pp.

Safety-Responsibility Bill. American Automobile Association, Washington, D. C. 1944. 47 pp.

State Motor Vehicle Code. State Motor Vehicle Department.

The Rules of the Road at Sea. LaBoyteaux, W. H. Baker, Vorhis & Co., 119 Fulton Street, New York City. 1920. 277 pp.

The Uniform Vehicle Code. U. S. Public Roads Administration, Washington, D. C. 1945. Separate pamphlets: Act I, 26 pp.; Act II, 18 pp.; Act III, 6 pp.; Act IV, 16 pp.; Act V, 54 pp.

Uniform Act Regulating Traffic on Highways (Act V). U. S. Public Roads Administration, Washington, D. C. 1945. 54 pp.

CHAPTER XI

Observance and Enforcement

Do You Know:

How preferable observance is to enforcement?
How the public can be educated to better observance?
What enforcement practices are best?
The main obstacles to good enforcement?

OBSERVANCE

TRAFFIC regulations, as you know, grow out of experience and are designed to be protective. If you violate a regulation, you drop its protection.

The protective nature of traffic regulations is shown by the fact that *practically every traffic collision involves at least one violation.*

Not all violations, it is true, result in accidents. But continued violations almost certainly lead to accidents. Take the case of Wisedriver Joe whose habit was to laugh off his traffic violations with "It's all right if you don't get caught." Gradually, he became more and more careless and illegal in his driving. Then one day—a hillcrest—Joe out of his legal lane—a terrific crash—several persons seriously injured and in

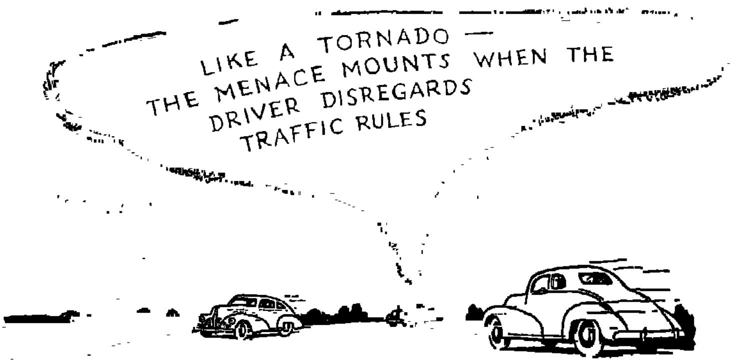


FIG. 128. Repeated traffic offenses become more and more serious.

the hospital—Joe facing an operation, a heavy fine, and large damage charges on the other car and its passengers. Actually, Joe had piled up bad driving habits and had been preparing for that collision every time he committed a traffic violation.

Violations pile up accidents. So police forces are more concerned in forestalling the accident by encouraging observance than in punishing the offender after the accident.

Observance Is Better than Enforcement

Ask your police chief how many officers would be necessary in your community to *force* people to obey all the traffic laws. He will tell you that no city could possibly afford enough police officers to enforce traffic laws on an unwilling citizenry. *No law can be successful in a democracy unless a large majority of the people obey it of their own free will.*

FIG. 124. Which is better for public good?

A major goal in traffic regulation is to secure voluntary observance. Progressive police departments work toward convincing the public that it should *help prevent accidents by observing regulations.* Traffic officers would much rather aid and guide drivers and pedestrians in observance than be forced to arrest them for violations. But as long as people don't obey regulations, officers must make arrests.

Drivers and pedestrians choose between observance and enforcement. As a matter of fact, heavy need for enforcement

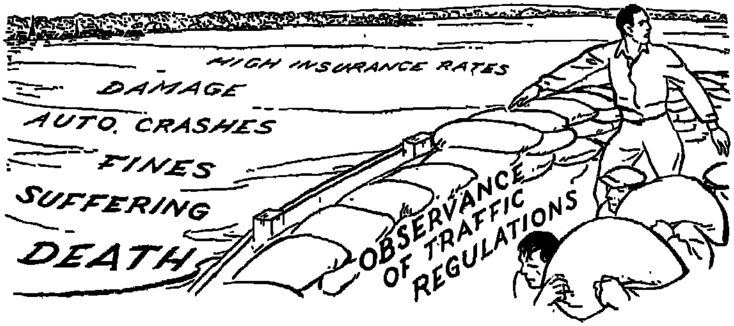


FIG. 125. Let's help make this levee floodproof.

in any community is a symptom that something is wrong in the traffic picture. Poor observance means, in addition to accidents:

Traffic delays
Increased taxes for larger police forces
Increased insurance costs
Heavy enforcement, with its arrests, fines, and penalties
Decreased enjoyment in using highways and streets

The public brings all these ill effects on itself when it does not obey protective traffic regulations.

How Can Better Observance Be Obtained?

To help improve observance, the public needs:

1. Reasonable, uniform, up-to-date traffic regulations.

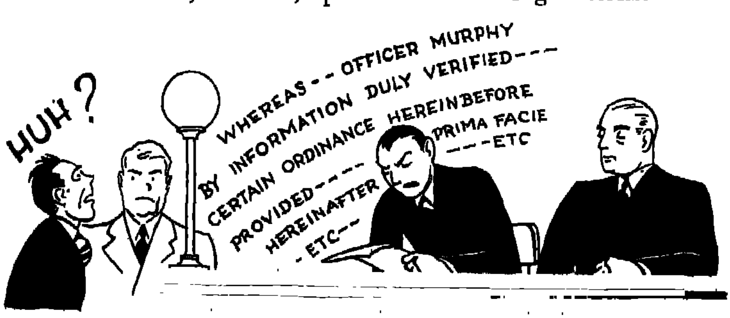


FIG. 126. The average citizen does not understand legal terminology.

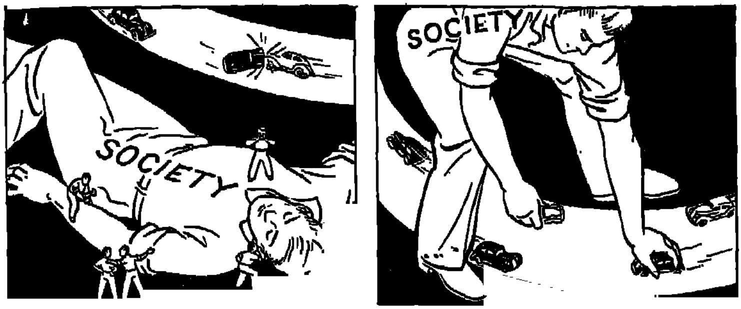


FIG. 127. As society awakens, those who do not "play the game" will be removed from the highway.

2. Digests of regulations so simply stated that every driver and pedestrian can understand what he is supposed to do.
3. An understanding of why various regulations are instituted and why they are important.
4. Realization of the serious results of non-observance.
5. Proper enforcement to stimulate observance.
6. Mass education to promote observance.

Society has been too much asleep about the traffic observance situation. But it is awakening. And when really awakened to a need, society is like a powerful giant. It will remove from the highway those who will not "play the game" in accordance with the rules. Among the many improvements which the awakened giant will put into effect will be *the systematic training of every individual for modern traffic conditions and law observance.*

Driver training classes, such as were described in Chapter II, will be a big factor in training specialized groups to observe traffic regulations. But there are large numbers of persons who are not reached by specialized programs. For these people, we need *mass education* in traffic regulations for both drivers and pedestrians.

Mass Education

The best programs for mass education in observance are not those which instill fear but those which increase understanding.

Fear of being arrested and fined, fear of being taken to court, and fear of license suspension can control drivers to a certain extent. But better than fear is the self-discipline that drivers and pedestrians who understand traffic regulations *impose on themselves.*

A clear understanding of the reasons for traffic regulations is a better incentive to good driving than the presence of traffic officers at occasional intersections.

Mass education for observance can be undertaken in a variety of forms:

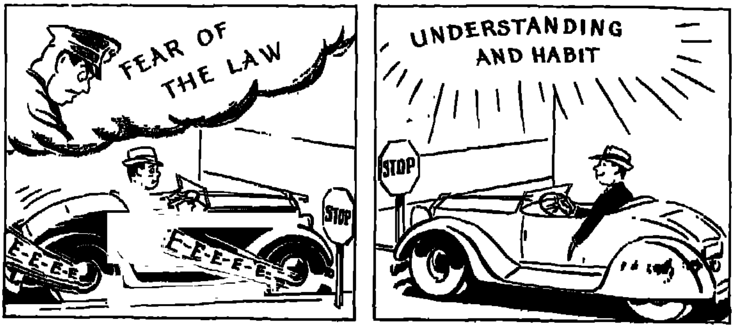


FIG. 128. There is a glow of satisfaction in driving legally, with skill and understanding.

Newspaper Programs—Newspaper crusades for better observance and accident reduction are good. Papers have helped observance programs by means of:

- Editorials
- Daily traffic tips—for drivers and pedestrians
- Sketches, diagrams, and cartoons
- Records of convictions in serious offenses
- A daily "clock" or "thermometer" showing accumulated fatalities
- Picture strips—showing how accidents happen
- Traffic articles

Radio Programs—Traffic education by radio can be of several types:

Dramatizations of traffic incidents
Traffic club programs
Broadcasts of traffic court proceedings
Traffic interviews
Quiz programs
Spot announcements and warnings

Uncle Red's ABC Club, which deals with traffic problems of children, has now been on the air since 1926 from Providence, R. I. It boasts over 100,000 members. In many cities, high school students have dramatized serious accident cases over the radio, emphasizing the value of public cooperation in observance.

Visual Aids—Posters and cartoons in elevators, offices, stores, factories, and public places help boost observance. Warning signs on sidewalks can remind pedestrians to honor crossing regulations. Movie shorts have a wonderful educational value.

Attractive films have been made to encourage observance and decrease traffic accidents. Interest in traffic safety films by companies which produce entertainment films is increasing. School groups, under expert guidance, have made some splendid traffic films.

A less expensive visual aid is the sound-slide film. A series of still pictures on 35 millimeter film stock is shown in quite rapid succession "in step" with a running verbal discussion

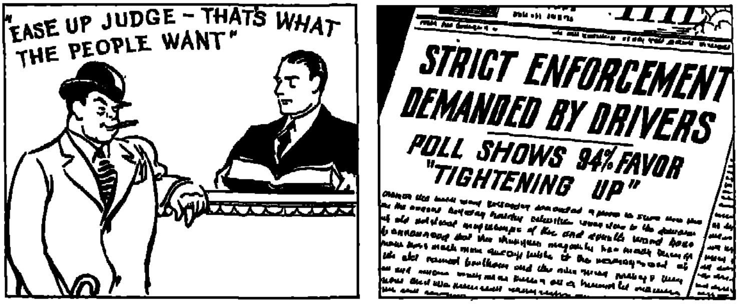


Fig. 129. Polls of public opinion indicate that the public desires strict enforcement.

transcribed on a record and heard with the aid of a loudspeaker. Numerous excellent presentations of this type are available.

Safety Sabbaths—The interest of ministers in conserving human life through traffic law observance has led them, in certain cities and states, to present city- or state-wide Safety Sabbath programs. The sermons for such programs emphasize accident-prevention through acceptance of personal responsibility and through sportsmanship and courtesy in driving.

Sounding Public Opinion—A poll of public opinion on traffic matters is a good move in mass education. Public opinion often crystallizes to support activities which polls show are widely desired. Polls make the public think about traffic problems and become more alive to the need for more general observance and stricter enforcement.

A good illustration can be seen in the problem of "fixing." A judge may be told by selfish politicians that he should be more lenient in his sentences—that people want such leniency.

Fig. 180. Good enforcement helps weed out poor drivers and pedestrians who fail to cooperate.

But a poll of public opinion may show that the people desire observance and strict enforcement. In fact, such polls taken in a score of cities indicate that well over 90% of the people do want stricter enforcement.

ENFORCEMENT

When observance falls down, enforcement must step in.

Where enforcement is needed, progressive police forces are interested in *selective enforcement.* That means that they are most interested in the major violations which cause serious accidents. They try to use their men at those places where the most serious violations and accidents occur, and at the times of day and night that have the worst records. They want to be on hand to *prevent* violations. That is enforcement at its best. But where violations persist, in spite of the police officer's efforts at prevention, *enforcement must restrict or remove from the highways those who will not cooperate.*

Some Troubles with Enforcement

Unfortunately, not all enforcement is effective and progressive. Too much attention is still given, in some places, to offenses which do not contribute to accidents. There is too little emphasis on selective enforcement. As a result, the number of convictions for violations is too low in proportion to the number of injury accidents.

Some enforcement is still designed mainly for revenue purposes. "Fining mills" still operate, especially where the vicious and antiquated "fee system" exists. Under the fee system, magistrates, and sometimes, indirectly, officials with police power, get paid for services only when drivers are convicted for alleged violations.

Some police are not properly trained, and some are not neat, courteous, and reasonable. "Fixing," whereby favored or influential persons, though guilty, are not punished, is still all too common. Untidy, crowded, even disorderly courtroom conditions sometimes exist. Ineffective penalties are imposed, and all too often the magistrate does not give cases the consideration they merit.

An increasing number of cities have good enforcement, but in many places, there is still much room for improvement.

Improvement of Enforcement

If newspapers and civic leaders indicate emphatically their support for high grade, progressive, traffic law enforcement, the chances of having it are greatly improved. Even the wary

politician has to approve those things which he believes the people strongly want. So it is very important for the public to speak up and let it be known that it wants good enforcement. Officials in charge of enforcement must be real leaders. They must have the power to advance men in enforcement service on the basis of merit and to transfer or dismiss men who do not work out well.

The public must not expect enforcement officers to perform miracles. And that is about what the public expects when it fails to give its officers proper equipment and support. In order to function in a modern, up-to-date, effective manner, enforcement officers must be assured of:

Adequate personnel
Good officer training
Good supervision
Proper equipment
Court support
Public support

1. Adequate Personnel

In most states and in many cities, more police officers are sorely needed to cope with ever-growing traffic. Check up on how many officers are available, at any one time of day or night, to patrol even the major highways of your state and city. How many miles must each officer "cover"? Can he

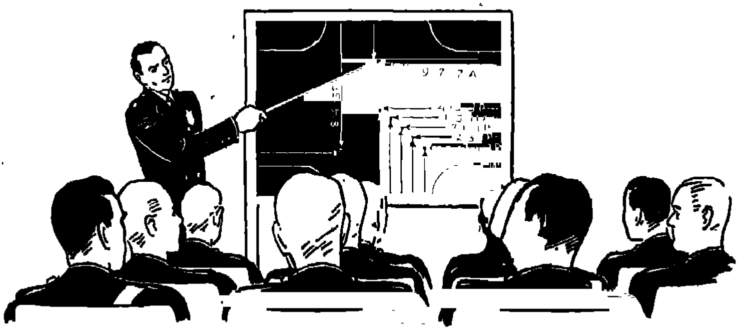


FIG. 181. Specialized training is needed for police protectors and aids.

be expected to do a good job on that mileage—especially considering the time he must devote to appearances in court, to accidents, and to other special duties?

In cities, from 25 to 30 percent of the total police force should usually be assigned to traffic. But police have many duties and in many places the only solution is to employ additional men for traffic duty. The Safety Division of the International Association of Chiefs of Police has established, as a minimum standard for cities, four full-time traffic officers for each 10,000 of population.

2. *Officer Training*

Up-to-date training of both traffic officers and drivers results in increased respect and cooperation. This, in turn, is reflected in safer and more pleasant traffic conditions.

Well-trained officers are needed to regulate traffic and save it from confusion. They serve as a balance wheel in a very complicated activity of society. They act as constant reminders of the need to obey regulations and to share streets and highways in a sportsmanlike manner.

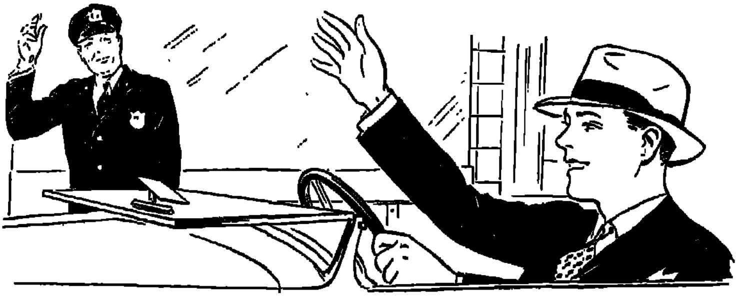


FIG. 182. Up-to-date drivers and up-to-date traffic officers cooperate with each other.

The traffic officer is trained to spot and control the traffic "chiseler," to correct and inform the ignorant, and to weed out the drunken drivers, the reckless speeder, the irresponsible violator, and the jay-walking pedestrian. He must be well trained in attitude. For an important part of his job is to

give quiet, courteous help and advice to the law-abiding driver and to watch for opportunities to help educate the public in good driving practices.

The job of handling traffic is much different today from what it was ten years ago. Progressive traffic police units now have specially trained accident-investigation squads that go immediately to the scene of accidents, aid injured persons, and seek evidence for court convictions, if violations have occurred.

There should be enough accident-investigation squads to investigate 85 to 90 percent of all traffic accidents. Generally, this requires one squad to each five traffic fatalities per year. These squads are so effective in numerous cities that high percentages—often two-thirds or more—of the hit-and-run drivers are apprehended and convicted.

Specially trained officers must know how to use modern scientific equipment for determining extent of intoxication. They must apply scientific crime detection techniques to the more serious and difficult accident cases. They must use modern techniques in improved preparation of cases and in more effective presentation of cases in court.

Other officers spend their time compiling records and studying them to find out how to improve enforcement. Still others devote their time to work in the schools, to talks, and to other educational activities.

FIG. 183. Using radio-equipped cars, the accident-investigation squad employs scientific methods in handling serious accident cases.

Since today's police traffic work requires well-trained men, more and more police departments are carrying on training schools. Interested colleges also are offering special police

training courses, with encouraging results. Do your state and city have police training schools? Have one or more of your police executives been trained at some institution which gives professional instruction in traffic police administration?

3. *Supervision*

All full-time traffic officers should be under the command of one police official of rank just under that of the chief. If men are to work on a job effectively, they must be well supervised. Frequently, the police official in charge of traffic is handicapped by lack of enough sergeants and lieutenants to do a good job of supervision. Adequate supervision must be provided.

4. *Proper Equipment*

In some localities, police are handicapped by lack of adequate equipment for good enforcement. Compare the condition of the motorized fire apparatus in your community with that of

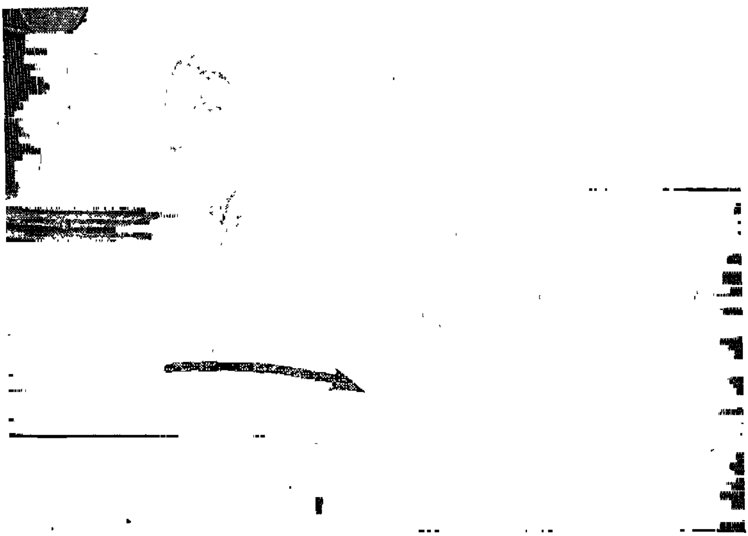


FIG. 184. Police accident investigation squads make moulage casts of tire tread marks and use them in apprehending hit-and-run drivers.

the squad cars and motorcycles of the police department. In many cities, the fire department is supplied with equipment which is in excellent condition, as it certainly should be, but the police are expected to catch speeders, red-light runners, and hit-skip drivers in worn-out or out-of-date cars or motorcycles which should have been "turned in" long, long ago.

According to standards, from 50 to 75 percent of traffic police should be motorized, with effective equipment and with enough reserve automobiles so that they can be substituted for motorcycles in bad weather.

City traffic police assigned to accident investigations, and all state patrolmen, should have cars equipped with two-way radio, brake testing equipment, cameras, and scientific equipment for testing degree of intoxication.

In many police traffic headquarters, you find a lack of modern files, record systems, and other essential equipment. The public cannot expect good enforcement work without modern equipment in good condition.

5. *Court Support*

Unless the magistrate and the police cooperate, the best enforcement efforts of the traffic division will fail.

Sometimes the public blames the magistrate, when the trouble is that there are too many cases to be handled, and the magistrate cannot give each case the time it deserves. Instead of blaming the magistrate in such cases, a Violator's Bureau should handle uncontested, non-moving, first-offense cases by accepting scheduled fines without hearings.

The police should follow a policy of bringing in better prepared and stronger cases. Often the state loses an important case because the police and the prosecutor have not adequately prepared their court presentation. When police pay more attention to selecting strong cases and to preparing them adequately for court hearings, there will be better relations between the police and the courts.

Another way in which enforcement can be improved by court work is to set up a separate Traffic Court for handling traffic cases only. Even if there are not enough cases to keep a magis-

trate busy full time, it is desirable to have one magistrate handle all traffic cases by reserving certain days for the purpose. There is too great a tendency for both police and courts to drop violation charges if the drivers involved agree on payment of damages. In some communities, drivers who violate a traffic law and cause a serious crash are much less likely to be convicted than drivers who are violators but are not involved in accidents. This is indeed a miscarriage of justice.

Still another practice defeats justice. Instead of supporting police work, some magistrates, and indeed some other officials, are guilty of "fixing" traffic cases so that deserved penalties are avoided.

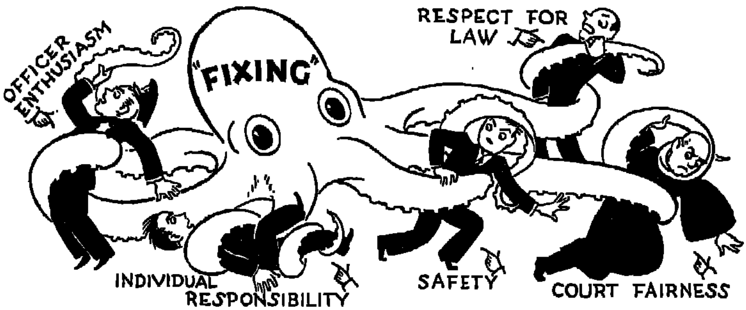


FIG. 185. The octopus, "FIXING", attacks at many points.

Many "fixed" cases never get to the judge handling traffic cases at all. Offenders are simply not prosecuted. The records stay in the files; the case is never called out. There are numerous ways of defeating justice when "the fix is on."

Unfortunately, "fixing" has a very bad effect on enforcement officers. How can a traffic officer continue to be enthusiastic about risking injury or death to arrest speeders, hit-and-run drivers, and red-light crashers if, as was true in one city, nine out of ten of his traffic cases failed to result in convictions? To add to his discouragement, the officer sometimes has to appear in court several times on such cases, often on his own time.

Can you expect officers to risk arresting privileged violators if they know the result will be a transfer "to the sticks," or a remote section of the city?

6. Organized Public Support

Of all the aids the police need in order to improve traffic law enforcement, organized public support is the most important. There will be excellent enforcement where an informed public, under strong leadership, demands it. Favoritism, influence, "fixing," and similar abuses cannot stand the searchlight of

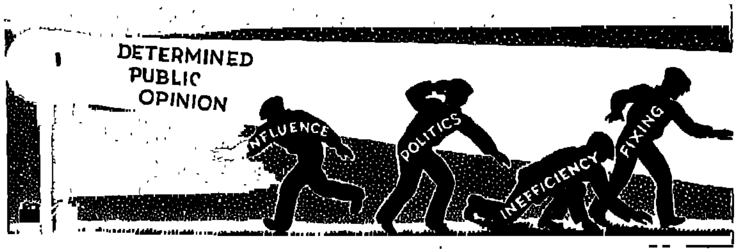


FIG. 186. They can't stand the searchlight!

public inquiry. Such evils exist primarily because those who are guilty of them believe that the public is not interested enough to care. In fact, politicians will generally be glad to be rid of the nuisance of using unfair influence to aid violators, *provided* EVERYONE *stops the practice.* The policy of "no fix" but "face the music" if you violate is being adopted in an increasing number of cities and states. This policy is aided by having regular audits made of traffic tickets and of enforcement results, and by making such information public—so that everyone knows what is being done.

Organized public opinion can also cause state leaders and city fathers to provide the men, money, equipment, and support that are needed for good enforcement.

The public can get just about the kind of enforcement it really wants.

Enforcement Work as a Vocation

Today, there is a real profession developing in the enforcement field. Intelligent and ambitious youths are going to be

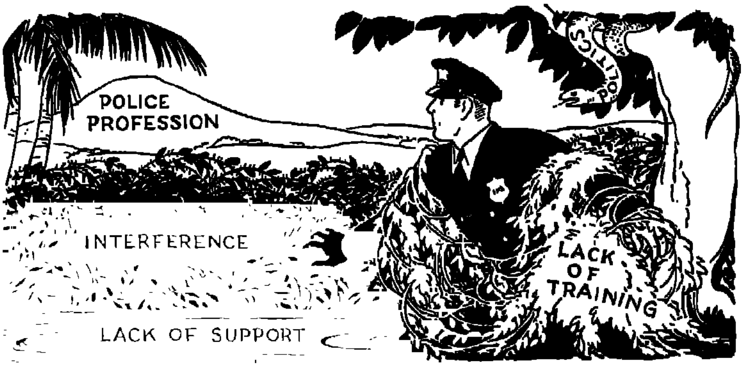


FIG. 187. With our help, nothing can stop him from reaching his goal.

attracted to it. Scientific methods are replacing "catch-as-catch-can" ways of doing police work. The public is showing increased appreciation for intelligent police activities which aid and protect them and their property. Colleges and universities are offering training for police work, especially in the field of traffic. Soon we may expect more colleges to offer regular courses to prepare youths for the new traffic police profession. Opportunities for the well-prepared will grow larger as the public increases its demands for traffic enforcement of high quality.

RESULTS OF GOOD OBSERVANCE AND EFFICIENT ENFORCEMENT

Can good observance and enforcement reduce accidents and improve traffic conditions? Records of the states of Rhode Island, Massachusetts and New York; of Evanston, Illinois; Providence, Rhode Island; and Milwaukee, Wisconsin, have proved that they can. Most of these states and cities have long records of low fatality rates. Most have rates which are less

than half of the national rate. In all of these places, observance and enforcement have been incorporated into a progressive, all-round program, including good organization and administration, legislation, engineering, and education. And in all of these places improved *observance* and efficient *enforcement* are given much of the credit for the low fatality rate.

FIG. 188. Automobile fatality rates must be reduced. Above are traffic fatalities per 100,000 population for the year 1946.

DISCUSSION TOPICS

1. What ways do you think are most effective in influencing the traffic behavior of the general public? Why?
2. What are the advantages and limitations of the following media or methods for traffic education: (a) outdoor advertising; (b) posters in store windows, service stations, and elsewhere; (c) newspaper features and drawings; (d) radio announcements and radio programs; (e) moving pictures; (f) meetings and addresses; (g) special campaigns, such as safety week and courtesy week; (h) permanent community organization for safety work; (i) safe drivers' clubs?
3. Discuss the value of polls of public opinion for traffic education.
4. Under what circumstances do you think fear should be used to influence traffic behavior?
5. Why is enforcement of traffic regulations so difficult?
6. How important do you regard enforcement of overtime parking in the prevention of accidents? Why is so much attention usually given to parking violations? Who benefits from parking enforcement? How?
7. What causes many people to believe "It's all right if you don't get caught"? How does such an attitude make for trouble? How can it be changed?
8. What can your group do to encourage more general observance and sound enforcement of traffic regulations in your city? Consider the merit of organizing a "Committee for Traffic Improve-

ment" from your group. What *specific* activities of such a committee will be most likely to produce results?

9. What justification is there for traffic police stationing themselves on a side road where they are not in plain sight of motorists? What enforcement purposes are not well served by that procedure? Which are served?
10. Define and illustrate "selective enforcement."
11. How can the man-in-the-street be brought to realize more definitely the bad effects of "fixing" and other evils which affect enforcement?

PROJECTS

1. Interview your traffic court judge. What are his main problems? What does he think needs most to be done to reduce accidents? Does he think a fine is the best deterrent in each case? If not, what other steps does he favor? Report your findings and your reactions to his views.
2. Find out from the police official in charge of traffic how nearly his staff meets the various standards set up by the Safety Division of the International Association of Chiefs of Police. What can your group do to help the police to meet these standards?
3. Interview a superior officer in your state's highway patrol. Find out how many men are on duty at one time and what area each man is supposed to cover. Get him to describe the various services patrol officers render to motorists while on patrol duty. Ask his views on observance and enforcement and on problems and needs of the highway patrol.
4. Secure the necessary data and figure out the "enforcement index" for your community for the last year. To do this, divide the number of convictions for violations involving *moving* vehicles by the number of injury accidents. If the resulting figure is not more than 5, find the reason. It should be 10 to 14. Why?
5. Devise and institute a plan for making traffic law observance "the thing to do" among members of your group.
6. Find out what five specific kinds of violations are producing the most convictions. Do you agree that these are the violations which need most attention? If not, what can you do about it?

FOR FURTHER READING

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PART III • How to Drive

CHAPTER XII

Before You Start the Engine

Do You Know:

How the gauges on the instrument panel help the driver?
What safety aids are within reach of the driver?
The uses of the different control devices?

SITTING AT THE WHEEL

SLIP BEHIND the wheel of the car. Whether you are a beginner or already know something about driving, you *will probably find yourself grasping the wheel with a pleasurable* thrill. "Let's go!" is your feeling.

Hold on a moment, please! Take a look at the instrument board in front of you. Take a glance at the pedals and but-

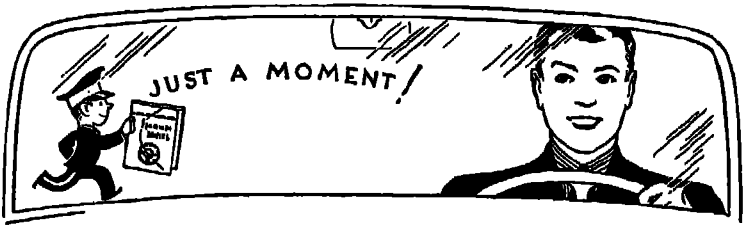

FIG. 139. Sportsmanlike driving requires preparation.

tons on the floor by your feet. Do you know what all those "gadgets" are for? You cannot handle this powerful eighty- or one hundred-horsepower "giant" without their help.

To make it easier to learn the uses of these instruments, suppose we classify them as:

A. Gauges
B. Safety Aids
C. Starting Devices
D. Control Devices

As each is described, identify it in its position and fix its use clearly in your mind.

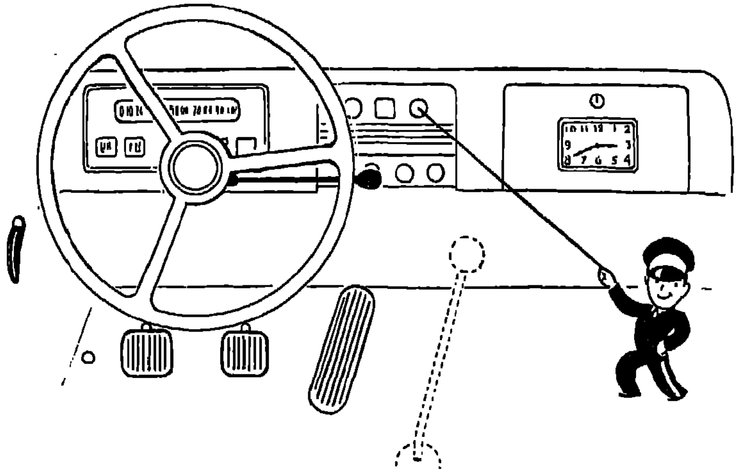

FIG. 140. Know the position and uses of each of the gauges and control devices.

THE GAUGES

Your car has a "diet" of five items: gasoline, air, water, oil and electricity. Of the six gauges before you on the instrument panel, four measure the supply or condition of these indispensable items.

1. Gasoline Gauge—A glance at this gauge tells the approximate amount of gasoline in the tank.

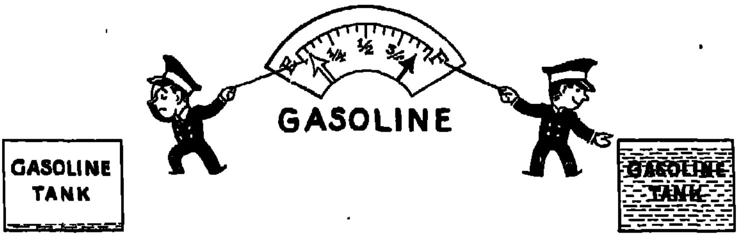

FIG. 141. Check the gasoline gauge frequently. Save a long walk to a filling station!

2. Temperature Gauge—The "power plant" under the hood of your car gets very hot when it runs. Water from the radiator is pumped through it constantly to help prevent overheating. This gauge indicates the temperature of the water.

The engine works best when the temperature of the water is between 160 and 180 degrees Fahrenheit. If the temperature rises close to the boiling point—212 degrees—take care! You may be able to put your finger on the cause of the trouble, or you may need help from a mechanic. Excessive temperature can be due to:

a. Insufficient water in the radiator.
b. Excessively heavy pulling.
c. A broken or slipping fan belt.
d. Insufficient oil in the crankcase.
e. A poor quality or wrong grade of oil.
f. Radiator honey-comb clogged with mud or insects.
g. Clogged, punctured, soft, or weakened hoses.

Other, less common causes of an overheated engine sometimes prove to be:

a. Improperly timed ignition.
b. An incorrect "gas" mixture.
c. Poor circulation of water in the cooling system.
d. A worn or broken water pump.
e. A leaking radiator.
f. Failure of the thermostat to operate properly.

Which of the causes of overheating listed above could you remedy yourself?

3. Oil Pressure Gauge—You no doubt understand the value of oil. You have been squirting things with an oil can for years—roller skates, your bicycle, the lawn mower, the sewing machine, and numerous other farm, shop, or household devices.

Oil is even more indispensable for the automobile engine. Certain rapidly moving parts must be constantly bathed in it. Take oil away, and the terrific friction at those parts would wear them out and ruin the engine.

Your oil pressure gauge shows the pounds of pressure being exerted on the lubricating oil to pump it to where it is needed. Normal oil pressure varies somewhat in different makes and models of cars.

The oil gauge can give some indication also of the amount of oil in the crankcase. If the amount is too low, the oil becomes too hot and the gauge generally registers a lower than normal pressure.

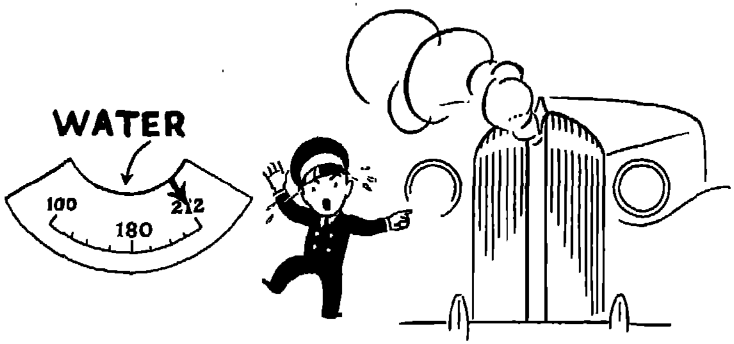

FIG. 142. Heed alarms from the temperature gauge!

4. Ammeter—The electrical system of your car might be compared to the nerves of your body. Electric current, flowing through such "nerves," sounds the horn, starts the engine, provides light, and so on. For all these tasks, your battery provides a reservoir of electric energy produced by the generator. The ammeter tells whether this supply of electrical energy is being reduced or built up. It measures the net flow of electrical current to and from the storage battery.

When everything is in good working order, the pointer on the ammeter will indicate—

CHARGE—if the engine is running and the generator is charging the battery by producing more electricity than is being used.

DISCHARGE—(1) if the engine is not running but lights are on, the horn is being used, the ignition switch is turned on—(2) if the engine is running only at idling

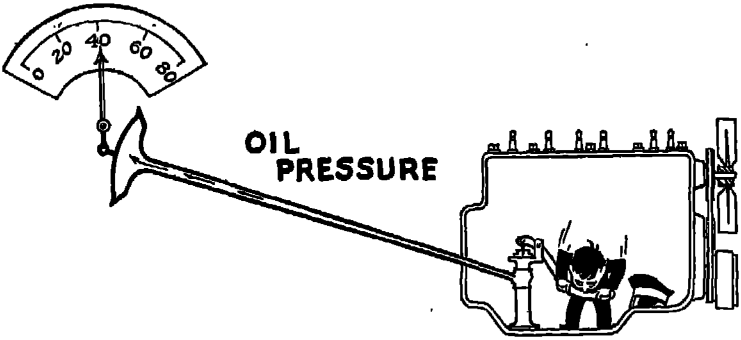

FIG. 148. Low oil pressure may result in burned out bearings.

speed, or at any time when the engine is running but electrical energy is being used faster than the generator is producing it. Under all these conditions current is being taken from the storage battery, which is being *discharged.*

ZERO—If the engine is not running and no part of the electrical equipment is being used, or if the generator is producing just enough current to offset that which is being used at the moment.

Under usual daytime driving, the ammeter registers a charge of about 10 to 12 amperes. For usual night driving, with lights turned on, but no radio in operation, the charge should be about 2 amperes. If the ammeter shows discharge when all switches are turned off, there is a short circuit, or "leak" of electrical energy. If the pointer shows DISCHARGE when *the engine is running rapidly, something is in need of attention.*

Some cars are not equipped with the charge, discharge, and zero type of indicator to tell whether the supply of electrical energy is being reduced or built up. A small colored light on some cars shows only when current is being taken from the storage battery faster than the generator is producing it.

When in use, the storage battery becomes warm, and water evaporates out of its cells. So the battery needs to be supplied with clean water, preferably distilled, at frequent intervals to

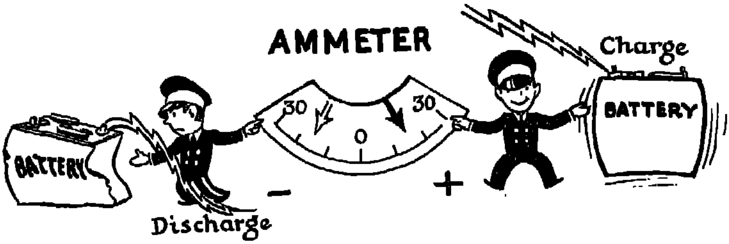

FIG. 144. A continuous discharge will soon weaken a battery.

keep the level of the battery liquid above the top of the battery plates. In summer, the amount of distilled water in the battery should be checked every week. In winter, a check should be made every two weeks. If this is not done, the plates may become dry and be injured, and the life of the battery will be greatly shortened.

5. Speedometer—This instrument shows the speed at which the car is traveling in miles per hour.

6. Odometer—This instrument shows through a slot on the face of the speedometer and indicates the number of miles the car has traveled.

The six instrument panel gauges described above are easy to locate and understand. Most of them are important indicators of the state of health of your car. Like an aviator, an expert driver refers to the instrument panel frequently to check on important conditions.

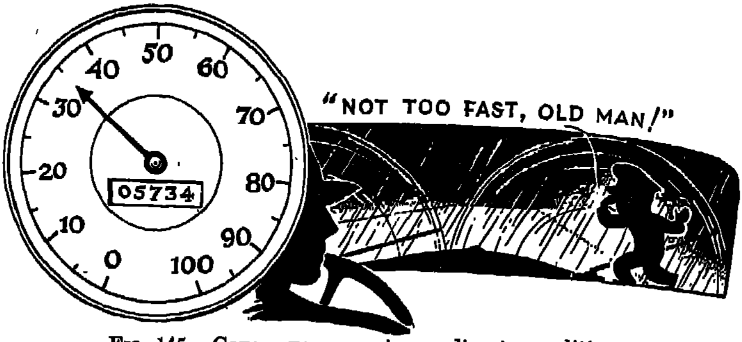

FIG. 145. Govern your speed according to conditions.

SIX SAFETY AIDS

Within easy reach of the driver there are five safety devices which help him to see. A sixth enables him to signal to other drivers and pedestrians.

1. Headlight, Tail-light, and Dimmer Switches—It is a far cry from the days of a swinging lantern on a wagon to the lights of our luxurious modern car. The light switch is either on the hub of the steering wheel or on the instrument panel. By moving the switch to various positions you get:

a. Parking lights on

b. Head and tail lights on

c. All lights off

Your car probably has an additional switch on the floor under your left foot. Making use of this switch is a courtesy when another car approaches at night. It shifts you from the raised beam lights, which blind the approaching driver, to a "non-glare" passing arrangement. By stepping on this foot switch again, after the car has passed, you return to the raised beam arrangement. Resting the left foot lightly on this switch when driving at night is a good driving habit.

The tail-light goes on when the headlights are turned on, and remains lighted regardless of what headlight arrangement you use. The dashboard panel is usually lighted by a special switch, but on some cars it is lighted when any headlight beam is on.

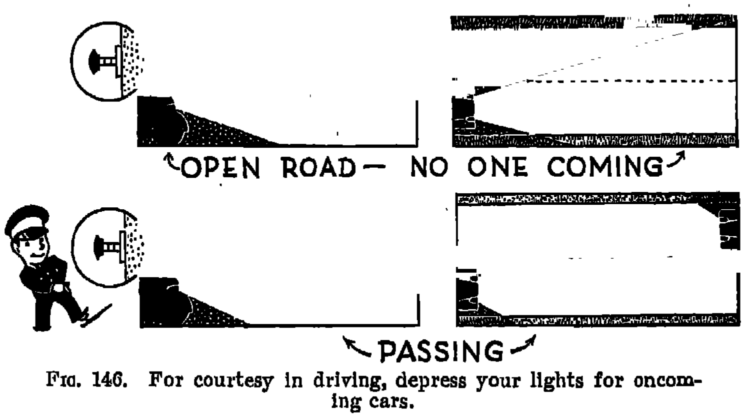

FIG. 146. For courtesy in driving, depress your lights for oncoming cars.

Your car may be equipped with a special switch position for city driving somewhat different from the open-road depressed beam arrangement. Learn when to use this switch and what its special advantages are.

Many cars have the added feature of a small colored dash light which shows when the raised beam lights are on. This device reminds you that your glare-producing lights are on and should be shifted to non-glare lights when you meet other cars.

2. Rear-view Mirror—Not having eyes in the back of your head, or a neck like a turtle's, you keep track of what is happening on the road behind you by a glance in the mirror near the top of the windshield. You must know conditions behind your car when you want to:

Stop your car, or slow down
Pass other vehicles
Park
Pull out from parking
Make a right-hand or a left-hand turn
Turn your car around
Change from one lane to another

If a car overtakes and passes you by surprise, you have failed to use your mirror properly.

3. Windshield Wiper—When rain streaks down your windshield, or sleet begins to form, you pull, push, or turn a little knob and set the windshield wiper to work. Learn where this knob is and how to operate it. It has no standard location.

Keep good rubber blades on your windshield wiper, and keep it properly adjusted to give a clear windshield in "dirty weather."

4. Sun Visors—Every driver, at some time or other, has been blinded by glare from the sun. Most cars have a sun visor above the windshield that can be tipped or pulled down to just the right angle for shading the eyes. This increases both the comfort and the safety of driving. Visors can be installed easily in cars that do not have them.

5. Windshield Defrosters—Some cars have special defroster slots in the top of the instrument panel. Hot air is blown against the windshield through these slots and prevents the formation of snow or ice on the outside of the windshield and "fogging" of the glass inside. Other defrosting devices are electrical heating arrangements and fans to keep warm air in circulation.

In freezing temperatures, an efficient defrosting method is indispensable for safe driving.

6. Horn Button—The horn button is usually on the hub of the steering wheel. Sometimes the driver blows the horn by pushing down on a large metal ring inside the steering wheel.

The horn is not there for the purpose of blowing pedestrians or cars out of your way. Don't be a horn tooter! Use the horn only when necessary. Sportsmanlike drivers are seen, not often heard!

FIG. 147. The unsportsmanlike driver attempts to "blow" pedestrians out of his way.

STARTING DEVICES

Modern starting devices start engines with safety and ease. These devices are four in number.

1. Ignition Switch—To turn on the ignition of your car you insert and turn a key in a keyhole on the instrument panel or on the steering wheel column.

"Back stage" behind the panel, the turn of your key closes a switch. The engine of the car needs a "hot" electric spark to ignite a mixture of vaporized gasoline and air. When you turn the key, you close the circuit and start the current neces-

sary for those sparks. But the engine must be turning over before the sparks are made. Turning the engine over is the job of the starting motor.

2. Starter Switch—The electric motor which turns over the engine is put in motion usually by pressure on the starter switch after the ignition has been turned on.

This starter switch may be on your instrument panel, or it may be a foot switch. In some cars, the accelerator pedal serves not only as a "gas" feed, but, when pushed all the way down, as a starter switch as well. One make of car is started by pushing all the way down on the clutch pedal. In some cars, the switch key turns on both the ignition switch and the starting switch at the same instant.

Never press the starting switch when the engine is running.

If the engine is so quiet that you don't know whether or not it is running, a touch on the accelerator pedal will let you know, without the danger of damaging your starting motor. A glance at your oil pressure gauge or at your ammeter will also tell you whether or not your engine is running.

3. Choke—To start a cold motor, the mixture of gasoline and air must be made richer in gasoline, because gasoline does not vaporize so well in a cold motor. The choke button does this trick by living up to its name. It "chokes" by reducing the amount of air going into the carburetor.

The choke button on the instrument panel can usually be identified by the letter C. Many cars now have automatic chokes which adjust themselves according to the changes of temperature in the engine, without the help of the driver.

4. Hand Throttle—On the instrument panel there may be a hand throttle button, sometimes marked with a T. It is used to regulate the rate of flow of gas. It was formerly pulled out when starting the engine, but with the automatic choke on most cars today, a hand throttle is seldom used.

If your car has a throttle button, note that the accelerator pedal moves down as you pull it out.

CONTROL DEVICES

By this time, you know the gauges. You know also how

to use the lights, the mirror, and the horn. You know how the engine is started by turning on the ignition and pressing the starting switch.

There are six other essential instruments. They are control devices which are used most of the time in actual driving.

1. Steering Wheel—Most people have grown up steering kiddie cars, tricycles, wagons, and bicycles. They know that the vehicle will always turn, when moving either forward or backward, in the same direction that the front wheels are turned. Vehicles with a steering wheel turn to the right if the steering wheel is turned to the right (clockwise), to the left if the wheel is turned to the left (counter-clockwise). It is a pleasure to learn to handle the wheel which governs the ingenious steering mechanism of a modern automobile.

2. Clutch Pedal—Think of your automobile as being made of two major units, (a) the engine and (b) the rest of the car.

Each of these units can run independently of the other. The body of the car can be set in motion—if someone pushes it—while the engine is still. The engine can run while the car remains stationary. But we can make the engine move the car by hitching them together.

When the car is "in gear" this hitching or unhitching is controlled by the clutch. When the clutch pedal is pushed all the way down, the two parts are unhitched. The power then extends only as far as the flywheel. When the clutch pedal is all the way up and the car is "in gear," the engine is hitched to the driving shaft and moves the car.

The clutch pedal is operated with the left foot. It is used:

a. When shifting from one gear to another
b. When bringing the car to a stop—in conjunction with the brakes
c. When starting the engine
d. When backing

3. Gear-Shift Lever—This lever, on the right-hand side of the driver, serves to change the position of certain gears so that the car will be in neutral or travel in low gear, second gear, high gear, or reverse.

Practically all manufacturers have eliminated the floor-positioned gear-shift lever, and now provide an electrical or mechanical gear-shifting device attached to the steering column or on the instrument panel. Proper use of the gear-shift lever will be explained in Chapter XIV.

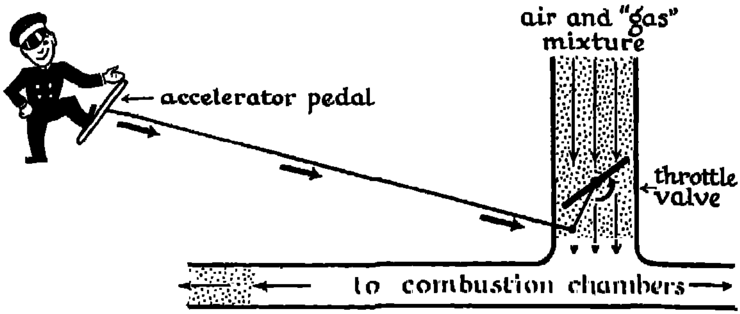

FIG. 148. The accelerator opens the "gate" or valve to permit air and gas mixture to enter the firing, or combustion, chambers.

4. Accelerator—This device is operated by varying pressures of the right foot. Like the hand throttle, which was mentioned among the starting devices, it controls the amount of gas fed into the engine and so regulates the speed.

The foot should always be in a comfortable position on the accelerator. The pressure should be applied with the ball of the foot high on the accelerator, the heel serving as a pivot. On long trips, women drivers find low heels less fatiguing and safer than high ones, because of the constant use of the foot on the accelerator.

The foot accelerator, rather than the hand throttle, is used while the car is in motion. This frees the hands for steering, shifting gears, and performing other operations.

5. Foot Brake Pedal—The brakes used to reduce the speed of your car or bring it to a stop are all operated together by pressure of the right foot on the foot brake pedal.

Foot brakes are of five types: mechanical, hydraulic, air, vacuum, and electrical. Mechanical and hydraulic brakes are

found on passenger cars; air, vacuum, and electrical brakes are common on trucks, buses, and tractor-trailers.

Mechanical brakes, through a number of mechanical units, transmit the pressure of the right foot, in greatly increased amount, to the brakes at the wheel.

With hydraulic brakes, the foot pedal forces a piston into a cylinder, causing brake fluid to transmit pressure equally to the four brakes through tubes filled with the fluid. This is the type now used in the majority of passenger cars.

Air brakes are operated by a piston driven by compressed air, while vacuum brakes are operated by the suction of a partial vacuum.

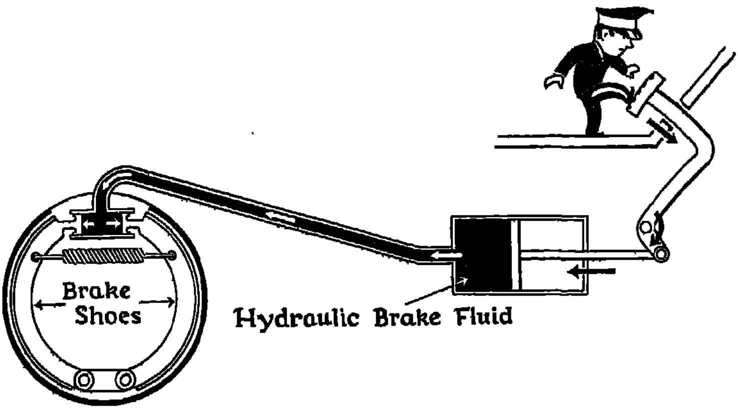

FIG. 149. With hydraulic brakes, pressure on the brake pedal is transmitted to the four brake drums. Only one drum is shown here. But the pressure is transmitted equally to all four drums, one on each wheel of a car.

6. Hand or Parking Brake—This brake is used in parking and in starting on hills. It is usually a lever to the left of the steering column, but on some cars it is an additional foot pedal.

On some cars, the hand brake operates on the drive shaft of the car and is independent of the foot brakes. On other cars, the hand brake provides an independent means of controlling the same rear wheel brakes which the foot brake pedal controls.

It is very important to release this brake fully when driving. Many a new driver has forgotten to do this and has paid for it with apparent loss of power and burned brake linings.

INSTRUMENTS ARE IMPORTANT

You have been getting acquainted with the gauges, the safety devices, the devices that start the car, and those that control it in action. Go over them systematically many times, until you recognize them at sight, and until you know their *uses* well. Sit in the driver's seat and touch or use each one until its position and "feel" are familiar.

These devices are so simple that before long their use becomes automatic. Even the simplest, however, is highly important for safe and efficient operation of your car. The last group, the control devices, can be mastered only by use in actual driving. Their operation will be made clear in Chapter XIV.

DISCUSSION TOPICS

1. A man driving along a country road noticed that his car was getting sluggish. He noticed also an unfamiliar odor as of hot metal and oil. He glanced at his water temperature indicator and discovered that it registered very near to 212 degrees. What are some of the things that might be wrong with his car? Which could he correct himself? Under what conditions would he need a mechanic?
2. There are several "home-made" ways of treating a windshield to prevent ice and snow from collecting on it and dangerously reducing visibility. Make a list and discuss the effectiveness of any of these methods you know.
3. Discuss the importance of a thorough knowledge of the purposes and operation of gauges and control devices in effective driver training.
4. Why does the oil pressure gauge give a higher reading when the motor is cold than when it is hot?
5. What would you suspect to be the trouble if the car were operating satisfactorily but the ammeter registered zero at all times?
6. Why should the liquid level in a battery be checked more frequently in summer? Why should the degree of charge be watched more closely in the winter?
7. Explain how a glance at the oil pressure gauge or at the ammeter can let you know whether or not the engine is running.

8. Which is more important, a gauge which shows the amount of oil in the crankcase or a gauge which shows the oil pressure? Why?
9. What damage may be done if the ammeter continually reads too high?
10. Explain the difference between "depressed" and "dimmed" lights. Which are preferable on the open road? Why?
11. How can you make certain that your stop light is working?

PROJECTS

1. Compare the devices on an old car with those on the latest model of the same make. List the major changes. Why have these changes been made?
2. Make a list of all additional car devices of which you have heard. Which would increase safety and which are merely "gadgets"?
3. Visit a first-class repair station and observe the servicing of both hydraulic and mechanical brakes. Study more complete descriptions of various braking systems and tabulate their relative merits.
4. Make diagrams and compare the dash and control devices of different makes of cars.

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CHAPTER XIII

How the Automobile Runs

Do You Know:

How to identify the chassis parts?
How power is produced in a gasoline engine?
What preserves the engine against excessive wear and tear?
How the engine power is transferred to the rear wheels?

UNDER THE BODY

THE SHINING, streamlined body of a new automobile is an object of beauty and pride. But it is under the body that you find "the works." Strip off the body and you disclose the *chassis.*

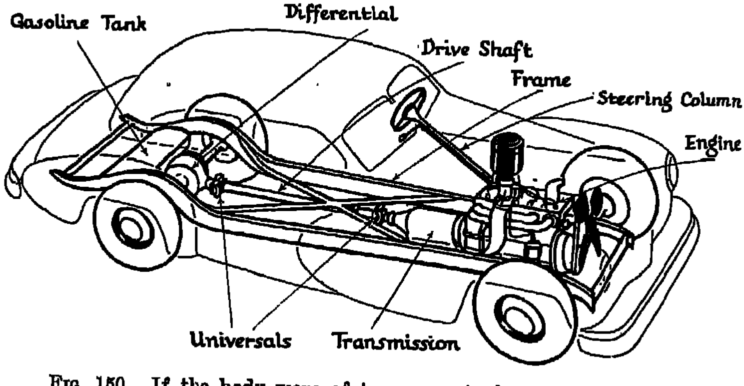


FIG. 150. If the body were of transparent plastic, you would see these operating parts.

Examine the stripped car and you find it made up of units held firmly together and designed to work in harmony. It is made up, principally, of five units:

1. The body, together with control devices and accessories
2. The frame and running gear
3. The engine or power plant
4. The power transmission system

5. The systems for various special functions, such as—

    Ignition
    Exhaust
    Steering
    Braking
    Cooling
    Lubricating
    Lighting

The chassis *frame* is the skeleton of your car. It is mounted on the springs, axles, and wheels. On it are mounted the body, engine, and power transmission system. Necessary parts of the ignition, steering, braking, cooling, lubricating, and lighting systems are held in place by being attached either directly to the frame or to other parts held firmly in place by the frame. The frame supplies backbone and firmness to your car and allows it to be a stable working unit.

By means of a chart, or better still, an actual cut-away car, make yourself thoroughly familiar with the various chassis units. Learn their locations, their special functions, and their functional relations to each other. As a driver, you will find great satisfaction in an ability to identify and understand the principal units of your car.

UNDER THE HOOD

Did you ever pass a car stalled by the side of the highway with its hood up and with the driver gazing sadly within? Suppose you were in that driver's shoes. What does a look under the hood mean to you? Is the automobile engine a sort of No-Man's-Land to you, or do you understand its various parts?

When you first see the many complicated-looking parts under the hood, you expect the principle of the gasoline engine to be hard to understand. Actually, it is a very simple principle.

The secret of automobile power is in *the production and control of explosions.*

Man discovered many years ago that when a certain mixture of vaporized gasoline and air is heated sufficiently by a spark

FIG. 151. Does Under the Hood perplex you, too?

there is an explosion. Explosions mean power. The trick was to *harness* this power—to confine it in closed chambers and make it do work, to make it turn wheels. This is just what man did when he invented the gasoline engine.

The Power Plant

Most of the parts under the hood are there for one of four purposes:

1. To prepare the gasoline for explosion
2. To furnish a place in which the gasoline-air mixture can explode
3. To furnish the spark which explodes the gasoline-air mixture at just the right time
4. To convert the force of the explosion into mechanical power that will turn the wheels

The large block of metal in the center under the hood is the engine block. It looks solid. But if you look inside you discover a set of hollow cylinders or tubes—six in a six-cylinder car, eight in an eight-cylinder car, etc. Study Fig. 152.

Each of these cylinders is closed at the top, with a spark plug screwed into it. Closing the other end of each cylinder, but able to work up and down in it, is a movable piston.

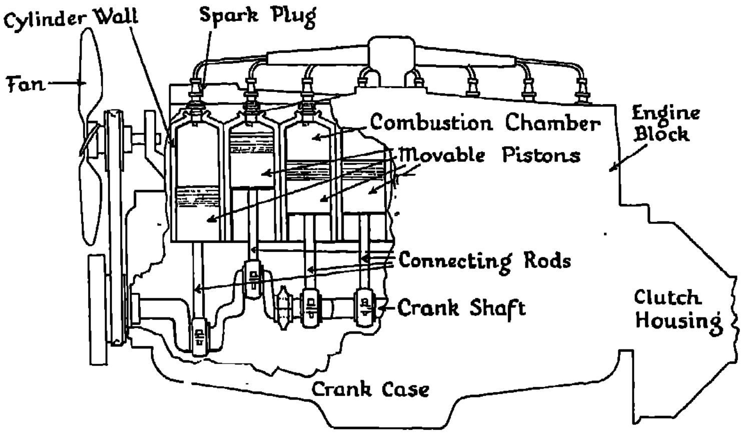


FIG. 152. Inside the engine block are cylinders containing movable pistons. The upper parts of the cylinders are combustion chambers with spark plugs extending into them.

A fountain pen illustrates the cylinder and piston idea. Hold the cap of a pen on the top and put the flat end of the barrel inside the cap. Now move the barrel up and down. The cap represents the cylinder, and the barrel the piston. Notice that when the barrel moves *up,* the space inside the cap gets smaller; when it moves *down,* the space gets larger. That space corresponds to the combustion chamber of an engine, and the combustion chamber is the place where the explosions of the gasoline-air mixture take place. See Fig. 152.

Gasoline will not explode in liquid form. So it has to be prepared for the combustion chamber by being mixed, in the carburetor, with just the right amount of air. See Fig. 153.

A fuel pump receives the gasoline from the tank in liquid form and sends it through a cleaner, or filter, to the carburetor. The carburetor is a vaporizing and mixing device. It vaporizes the gasoline through a spray nozzle and mixes with it just the right amount of air. You control this delicate job of the carburetor by two devices which were described in Chapter XII, the choke and the accelerator. With the choke, you control the amount of air that is mixed in the

carburetor with the vaporized gasoline, unless you drive a car on which the choke is automatic. With the accelerator, you control the amount of gasoline vapor and air mixture which goes into the combustion chambers. The more of this mixture you feed, the more frequent the explosions take place and the faster your car will go.

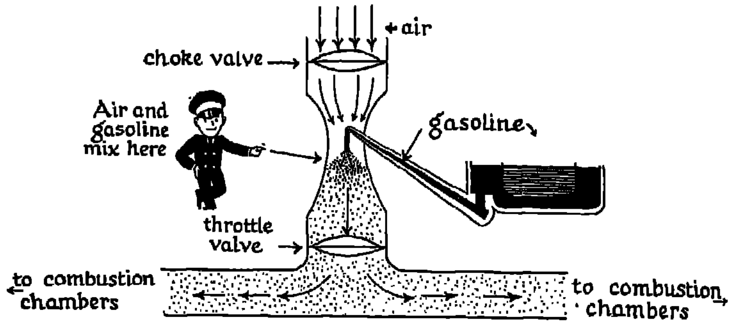


FIG. 158. The carburetor makes an explosive mixture from gasoline and air.

When the gasoline is vaporized and properly mixed with air, it enters the combustion chamber where it is to explode. But the gasoline-air mixture will not explode by itself. An electric spark is used to fire it.

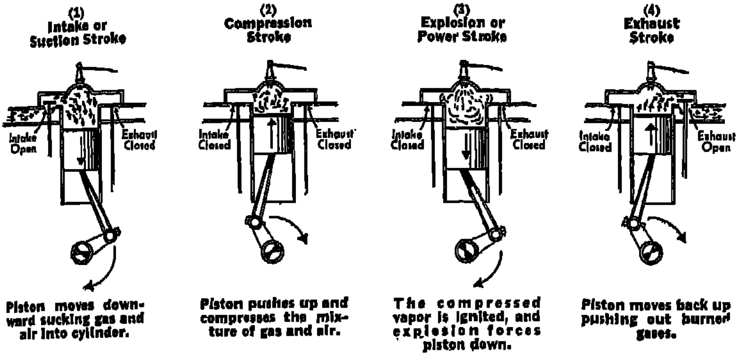
This spark is supplied by means of the spark plug at the top of each cylinder. Electric wires run to the spark plugs from a unit of the ignition system called the distributor. When the engine is running, electric current flows in these wires each time there is to be an explosion.

At the bottom of each spark plug, where it screws into the cylinder, the points do not quite meet. So, at this place, the electric current must jump a gap, thus causing a spark. As this spark is produced in the combustion chamber, it meets with the vaporized gasoline and air mixture and causes the explosion.

How is this gasoline explosion harnessed to drive the wheels?

When the vaporized gasoline explodes in the combustion chamber, it exerts terrific pressure on all the walls of the

chamber. But only one wall of the chamber is movable. That one wall is the movable piston making up the bottom of the cylinder. So the pressure of the explosion gives the movable piston a "power shove" downward.



Courtesy Customer Research Staff, General Motors Corporation

FIG. 154. What happens in each cylinder.

This downward shove of the piston is the beginning of the power that turns the wheels. For the pistons are fastened by connecting rods to a crankshaft. See Fig. 152. The downward strokes of the pistons rotate the crankshaft, just as the power strokes of the legs of a bicyclist cause the main sprocket to rotate. The turning crankshaft drives other mechanisms which "make the wheels go 'round."

Perfect Rhythm

A good tap dancer must have perfect *timing*. So must a fine dance orchestra. *Timing* is just as important to a gasoline engine as it is to Fred Astaire's nimble feet.

The smooth running of the engine depends on everything working *in perfect time*. The sparks in each cylinder must be introduced at just the right split second. Certain valves in the combustion chamber must be opened and closed in perfect rhythm. How is this done?

For each explosion of gasoline in the combustion chamber, the piston must make two round trips in the cylinder—that is, twice up and twice down. Each one of these four strokes of

the piston plays an important part in producing power. The four strokes of the piston take place as follows:

1. The piston is drawn down by the turning crankshaft. As this occurs, an accurately timed intake valve opens and the mixture of vaporized gasoline and air is sucked into the combustion chamber at the top of the cylinder. This is called the *intake stroke.* Fig. 154 (1).
2. The intake valve closes. The piston is then pushed up in the cylinder by the turning crankshaft. With this stroke, the piston compresses the gas in the combustion chamber, creating a very small space and great pressure. This is called the *compression stroke.* Fig. 154 (2).
3. By exact timing, the spark is now introduced and the compressed gas explodes. This explosion forces the movable piston down, causing the third piston stroke. This is called the *power stroke.* Fig. 154 (3).
4. The last of the four strokes is upward. At this time, an exhaust valve is automatically opened, and the upward stroke of the piston forces the burned gases out of the cylinder. This is called the *exhaust stroke.* The piston is now set in readiness for another series of strokes. Fig. 154 (4).

This series of four strokes takes place in each of the car's cylinders in well-timed rhythm. So there is frequent application of power to the revolving crankshaft. When you know how the rhythmically revolving crankshaft causes the rear wheels of the car to turn, you will have the basic story of how the car runs.

REDUCING WEAR AND TEAR

You would think that, with continuous operation, an engine would knock itself to pieces or burn itself out. You would expect tremendous wear and tear. This *would* happen were it not for two systems, which are built into the car—the cooling system and the lubricating system.

The explosion of the compressed mixture of gasoline and air creates not only power but tremendous heat. The parts

of the car subjected to this heat are made of especially durable, heat-resisting materials. But this is not enough. The engine must be supplied with some kind of cooling system to counteract the heat produced while running. So both water and air are used for cooling.

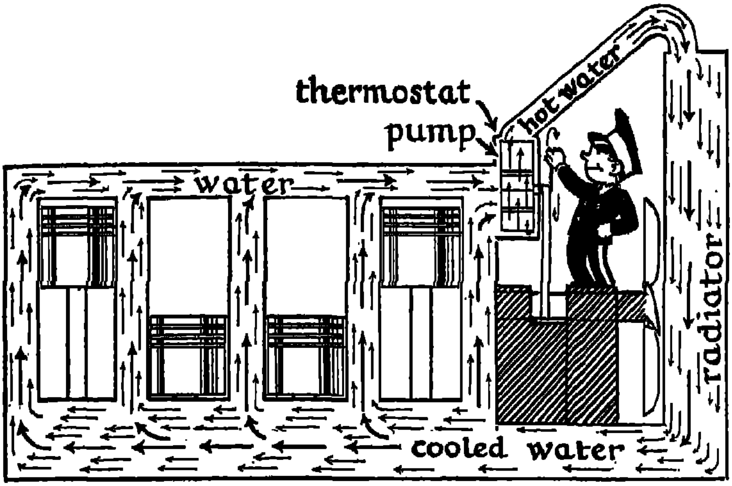


FIG. 155. Water cooled in the radiator is pumped around the cylinders through passages or "jackets", to keep down the engine temperature. Air from the fan also helps do this.

Water—You have seen water put into the radiator of a car. If you could follow its course, you would find that it is pumped through water jackets around the engine to keep down the temperature by continuous circulation. The apparently solid engine block described on page 208 is really honeycombed with water passages which carry water around the outside of each cylinder. The water is then cooled in the many small pipes that make up the radiator. See Fig. 155.

That water is needed! Without cooled water, parts of the engine would get red hot. In fact, combustion chamber temperatures can jump to as high as 1500 degrees F.

Air—The fan also helps to keep the heat down. This fan is kept revolving by a belt attached to the crankshaft. It

draws a draft of air through the radiator, cooling the water and blowing heat from the engine.

If either the water system or the fan belt falls down on the job, so that the heating is greater than the cooling rate, the engine gets too hot, and there is danger of burning out the bearings and bushings of the engine, and ruining other vital parts.

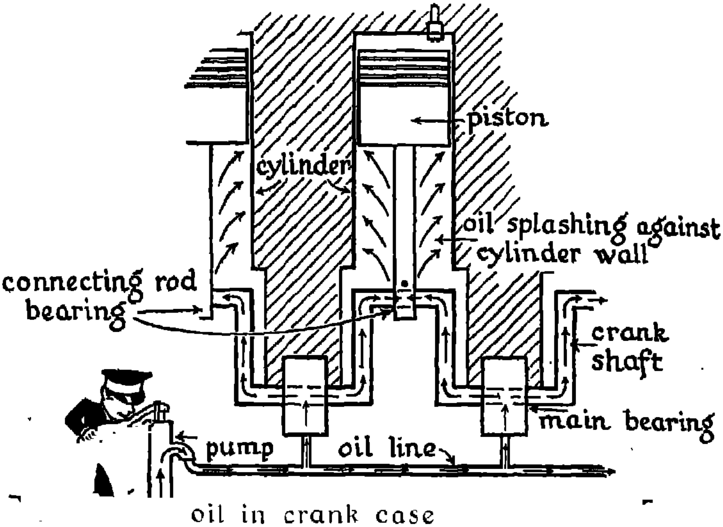


FIG. 156. Oil pumped to rubbing surfaces greatly decreases friction.

Oil—The lubricating system is designed to reduce wear to a minimum. Serious engine wear can be caused by the rubbing together of metal surfaces; so wherever such rubbing occurs, lubricating oil must be used to provide a slippery film between the surfaces. Study Fig. 156.

In one type of lubricating system, the rotating crankshaft and the connecting rods splash into a basin of oil at the bottom of the crankcase and scoop it up. By this means, the moving parts are bathed in oil. This is called the splash system.

Another type of lubricating is called the pressure system, in which the oil is pumped from a well in the bottom of the

crankcase to the points where it is needed. The pressure system is used in most cars.

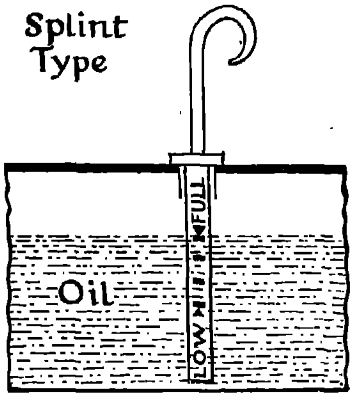


Fig. 157. Practically every modern car has the splint type of oil gauge. The proper amount of oil in the crankcase is essential to efficient engine operation.

The amount of oil in the crankcase can usually be checked by an oil stick on the side of the engine block. See Fig. 157.

You must check the oil level regularly. Lubrication fails without a proper amount of oil in the crankcase. This can mean an over-heated car, burned-out bearings, forced delays, and big repair bills.

TRANSFERRING THE POWER

A number of knotty engineering problems had to be solved in order to find ways to transfer the power which the automobile engine produces to the rear, or driving wheels.

The Flywheel

There is necessarily a little time between each of the many explosions that produce the engine's power. This means that there are short spaces of time between the power impulses them-

selves. So your car would move in a rapid series of little jerks if it were not for the *flywheel.* See Fig. 158.

The rotating crankshaft turns the large, heavy flywheel. When such a wheel is rotated it acquires momentum and is hard to stop. The momentum of this flywheel keeps the engine turning, without a jerking motion, between the power impulses.

The Clutch

Next, there was the question of connecting the engine to the drive-shaft which drives the wheels. This connection had to be made so that the engine's driving power could easily be detached from the drive-shaft. For there are, of course, any number of occasions when you want the engine running but do not want the car wheels turning. The connecting device which makes this possible is the *clutch.*

Put a pencil through the holes in two phonograph discs. If you leave a little space between the discs, you can spin one without spinning the other. Now press them close together. Rotate one, and you rotate both. The clutch discs work on the same principle.

The crankshaft ends in the flywheel, as you have seen. A friction plate, comparable to one of the phonograph discs, is

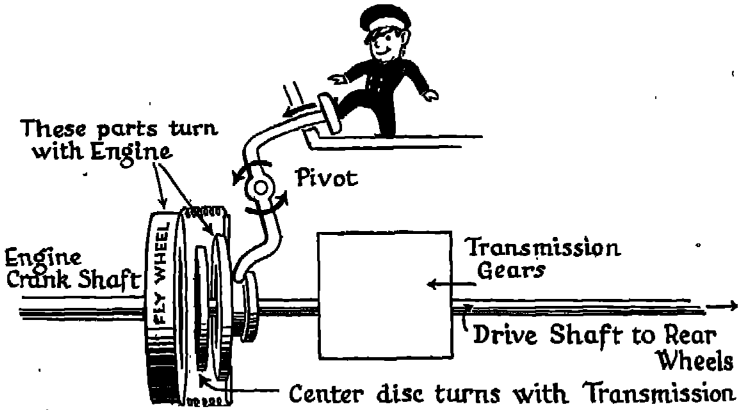


FIG. 158. When the clutch is disengaged as shown, only the engine crankshaft rotates. But when the clutch is engaged, the engine is "hitched" to the driving shaft. Then, unless gears are in neutral, the engine drives the rear wheels.

fastened to the flywheel. Running back from the flywheel and carrying the power on toward the rear wheels, is another shaft leading to the transmission. This shaft also has a friction plate on its forward end. When the engine is to move the car, the plate on this shaft is held firmly against the flywheel plate by strong springs. Spin the flywheel plate and you spin both plates.

When you want to disconnect the driving wheels of the car from the engine, so that only the engine will be running, you press the clutch pedal all the way down. This action separates the two friction plates, and the motion of one does not affect the other. The flywheel plate can continue to spin, but its effect stops right there. The engine continues to run, but its power does not get back to the car wheels.

If the pressure of the foot on the clutch pedal is released slowly, the plate on the shaft to the transmission does not have to start all at once at the same speed as the disc on the whirling flywheel. It can first slip a little on the other plate. This slipping allows the standing car to begin moving slowly and smoothly. It prevents that uncomfortable rabbit-hopping movement by which poor drivers often get under way.

In some cars, this slipping is accomplished by a fluid-type of coupling. Oil, driven by a rotating fan-type disc, causes a second similar part to revolve, much as mechanical friction in the customary clutch causes the plates to revolve. As engine speed is increased, the "slippage" decreases until the two plates are revolving at nearly the same speed. The engine is connected with the drive-shaft gradually and smoothly. In some cars there is no clutch pedal.

The Transmission Gears

In transferring the power, another engineering problem had to be met. An engine develops more power as it speeds up. For heavy pulling, a lot of engine power is needed, but not much car speed. In such cases, the engine must be able to run rapidly while the car is moving slowly. On the other hand, while the car is rolling along on the level, open highway, only a relatively little power is needed to keep it moving. Under

such conditions, it is possible for the car to move rapidly with a fairly slow engine speed. The *transmission gears* were designed to permit these variations between car speed and engine speed.

When two cogwheels of different diameters are meshed together, they turn at different speeds. The large one revolves more slowly than the small one. If the large wheel has twice as many teeth as the smaller one, it will make only one turn while the small wheel is making two. The transmission gears make use of this principle. Gears of different sizes, or ratios, can be meshed by means of the gear-shift lever. This means that, for any engine speed, the rear wheels can be made to rotate at different speeds.

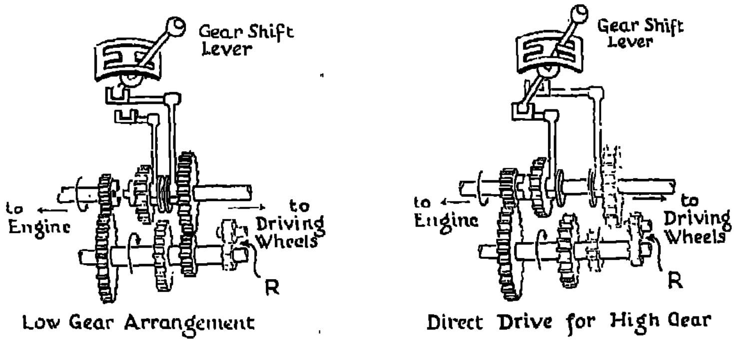


FIG. 159. By using different gear combinations, the driver can get power or speed, according to need.

Of course, in automobile transmission gears, there are not just two cogwheels. There are several possible combinations of gears in different *ratios* to each other. See Fig. 159. When you want the rear, or driving, wheels to turn slowly and powerfully—as when starting the car from a standstill—you use first gear, the "power" gear. To pick up more speed, but still with power, you shift to second gear, the "pick-up" gear. And for smooth running speed, you use third or "high" gear. To reverse the direction of rotation of the drive-shaft, so that the car can move backwards, you use an extra "reverse" gear, as shown at "R" on Fig. 159.

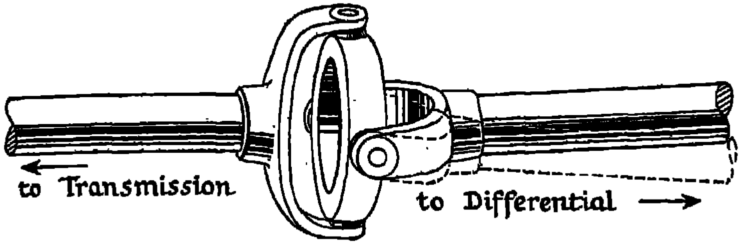


FIG. 160. In its simplest form, the universal embodies two "hinges" at right angles to each other. It allows vertical motion from the dotted line position to the solid line position. This "hinging" keeps the drive-shaft from breaking.

Significant changes may soon be expected in the transmission of power.

The Universal Joints

Some people, especially those with mechanical turns of mind, may wonder how the straight revolving drive-shaft can transmit power to the rear axle without breaking to pieces while the back end of the car moves up and down in going over bumps.

If the drive-shaft were one straight rigid piece, it certainly would break. But much as a person's arm has joints at the elbow and wrist to give it flexibility, the drive-shaft is provided with *universal joints.* These joints give the shaft flexibility and enable it to adapt itself to the vertical bobbing of the rear wheels as the car goes over bumps.

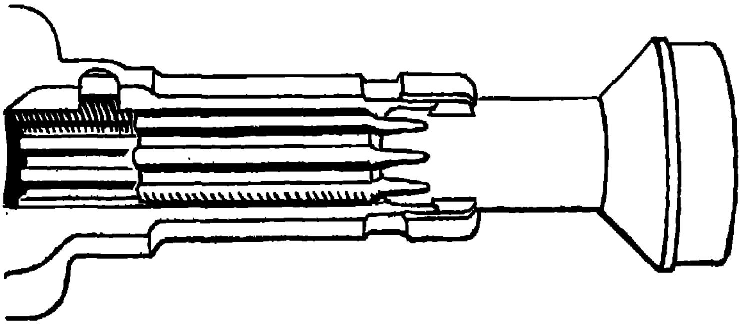


FIG. 161. The slip joint allows the length of the drive-shaft to change.

Flexibility in the *length* of the drive-shaft is also necessary. Bumping over road irregularities makes slight, but constant, changes in distance between the transmission gears and the rear axles. So the driving shaft has to change its length too. This changing length is made possible by means of a splined connection called a *slip joint*. This permits the shaft to slide slightly in or out as needed. See Fig. 161.

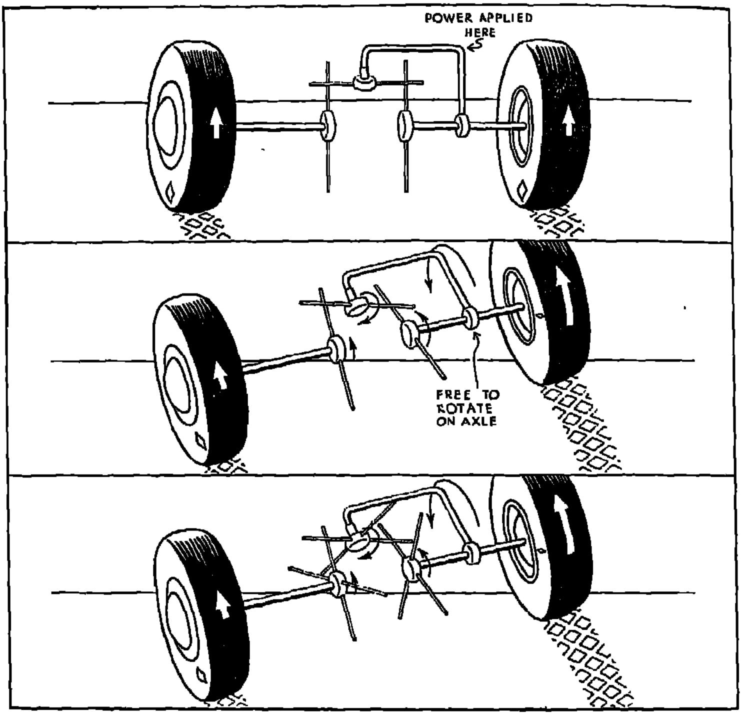


FIG. 162. This "stick"-operated series is intended to show how the differential permits the right rear wheel (in this case with car turning to left) to travel farther than the left. Note in the second drawing how the "power stick" has begun to turn in a clockwise direction as it pushes the "stick" attached to the right hand wheel farther than the "stick" attached to the left hand wheel, and that the right hand wheel has traveled farther. Of course, as the turn continued, the single "power stick" in the second drawing would slip off the two sticks it is driving. Hence, in the lower drawing extra sticks have been added so that rotation may be continuous.

The Differential Gears

Since the drive-shaft revolves at right angles to the rear wheels, a new problem exists. The direction of the power has to be changed. For, in order to turn the wheels, the rear axle must revolve at right angles to the drive-shaft. A small bevel gear, or driving pinion, on the drive-shaft, and a large beveled "ring gear" to turn the rear axles are used to take the power around a corner, so to speak. This mechanism works in a manner somewhat similar to that of the gears at the top of an old-time ice cream freezer, or on an egg beater. In this way, power is applied to the rear axle from one direction and works at another.

When a squad of soldiers marches around a corner, the outside man walks farther and faster than the inside, or pivot, man. In the same way, when a car goes around a corner, the rear wheel on the outside must turn faster than the one on the inside. A set of very cleverly designed gears on the rear axle—the *differential* gears—makes this possible. The differential allows the wheel on the inside of the curve to slow down while the one on the outside increases its speed, while constant car speed is maintained. See Figs. 162 and 163.

THE BRAKES

You now understand how the automobile is put in motion. How can a moving car be stopped?

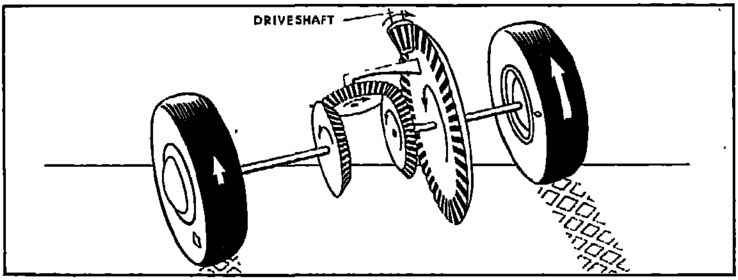


FIG. 163. This differential drawing shows the cogs or gears substituted for the "sticks" in Figure 162, and with drive-shaft pinion and ring gear in place. The ring gear is free to rotate on the axle shaft and does not drive it except through the differential gears.

Stopping is done by friction. This friction is applied to the rotating wheels by means of brake bands, or shoes, that can be either drawn tightly around the outside of the drums attached to the wheels, or, as in practically all passenger cars, expanded tightly against the interiors of the brake drums. If the brakes are mechanical, the brake shoes are forced against the brake drum by a system of levers. If brakes are hydraulic, an hydraulic brake fluid applied under pressure does the same thing. See Fig. 149.

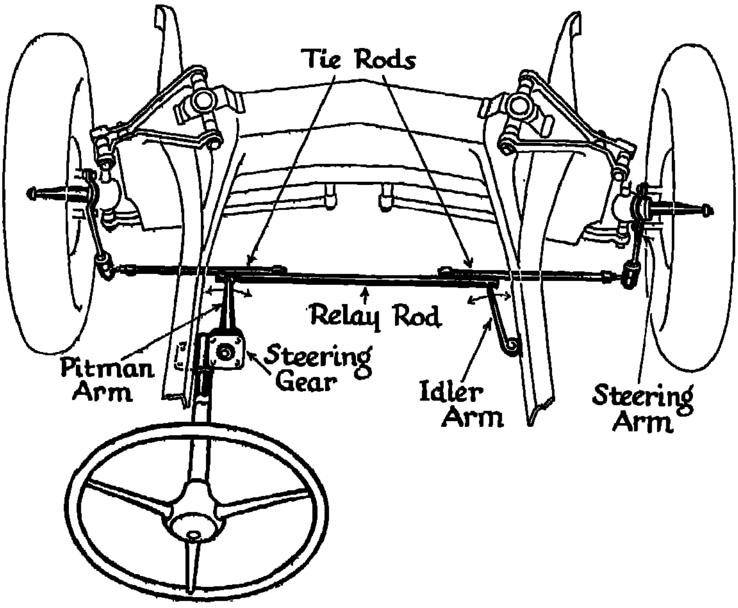


FIG. 164. How the steering mechanism operates on many modern cars. Heavy shaded parts show how motion is transmitted through the steering gear to the front wheels.

THE STEERING SYSTEM

The principal parts of the steering system are the steering wheel, steering column, and steering gear.

When you turn your steering wheel, you turn a worm or steering gear on the lower end of your steering column. This

worm gear causes motion of the Pitman arm. The Pitman arm is connected, by means of tie rods and knuckle, or steering arms, to the front axles, and its motion causes the front wheels to turn right or left.

The steering system, like the braking system, is a very critical part of your car. As a most important control device, it must always be in good working order.

DISCUSSION TOPICS

1. Explain clearly by what means the vertical motion of the pistons is converted into rotary motion.
2. Explain the function of the carburetor.
3. Just how is the power of the engine increased by depressing the accelerator pedal?
4. Why is the third stroke of the piston in a four-cycle engine called the "power stroke"?
5. What principal changes must be made in the front and rear axles in cars which have front wheel drive? Would this type of construction make the differential unnecessary? Explain.
6. Explain the function and the mechanism of the low, medium, and high gears in the ordinary passenger car.
7. How would you diagnose the trouble when you see a driver starting out with a succession of rabbit-hops? How could he correct this? Is there any possible explanation other than the one you have given?
8. What are the advantages and disadvantages of the increased numbers of cylinders now being used in the construction of automobile engines?
9. Why does gasoline "explode" less readily when the engine is started in cold weather?
10. How does "riding the clutch" damage the clutch facings?
11. Why is it dangerous to coast downhill with gears in neutral?

PROJECTS

1. Prepare a simple model with which to explain the four piston strokes. Write out a description of what is taking place with each stroke.
2. Make as large a list as you can of the mechanical devices commonly used in or around the shop, farm and home, that could illustrate the principles of the piston, crankshaft, flywheel, valves, carburetor, spark gap, radiator, fan, gears that allow connected parts to rotate at different speeds, gears that change the direction of power, and friction brakes.

3. Write a summary explaining the principle of the automobile engine in not more than 80 words.
4. Write out the "life history" of a drop of gasoline from the time it is put into the tank at the filling station until it has been fully utilized by the car.
5. Devise some simple mechanical set-up to demonstrate the principle of the simple disc clutch.
6. Make a list of all the automobile parts mentioned in this chapter. Divide your study group into two sections as in an old-fashioned "spelling bee." Let the instructor give out the terms in the list as he would give out spelling words. If a student cannot explain the term given him to the satisfaction of the instructor, he is "out" and the term goes to the next side. See which side can get the better score.

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CHAPTER XIV

Action!

Do You Know:

The qualifications of a good driving instructor?
The best techniques for starting, steering, and stopping a car?
How to shift gears smoothly?

YOUR INSTRUCTOR

THE TIME has come for actual driving! From this point on, you need a car to drive. And you need a licensed driver to assist you. You are lucky if you can have an experienced driving instructor. If no such experienced driving instructor is available, get the very best driver you can find.

Your early driving habits will depend on your instructor. So pick out a driver with a good, no-accident record—one who is skillful, responsible, and courteous to others. You want no "smart-aleck," "show-off" driver for an instructor. Neither do you want one who has a battered car or a record of complications with traffic officers. Choose only the best to teach you.

Ask the experienced driver who is to be your coach to follow the plan and instructions presented in this book. These in-

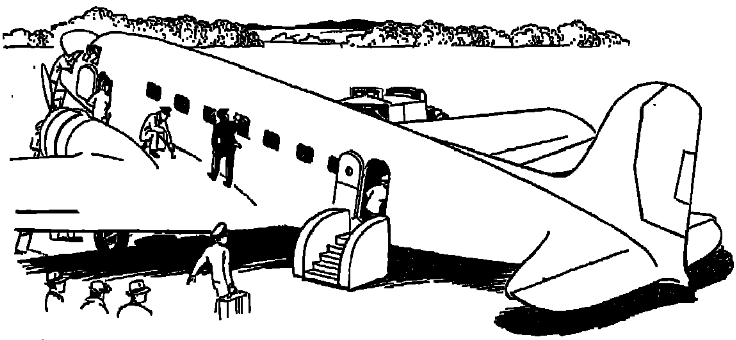


FIG. 165. Before an airplane takes off, every important part receives a careful check up. Your car should receive a similar inspection before being driven.

structions have been worked out by experts who have experimented with many methods and who have taught many people to drive. Study them with your instructor and insist on following them to the letter. This will prove to your advantage.

IS YOUR *CAR* READY?

Take a tip from the railroad engineer and the aviator. They check over their machines before they take them out. Check over your car. Be sure that:

The tires are inflated to the pressure prescribed by the tire manufacturer, and that all tires, including the spare, are in safe, usable condition.
The radiator is filled with water.
There is enough oil in the crankcase.
Each cell of the battery has its plates well covered with liquid.

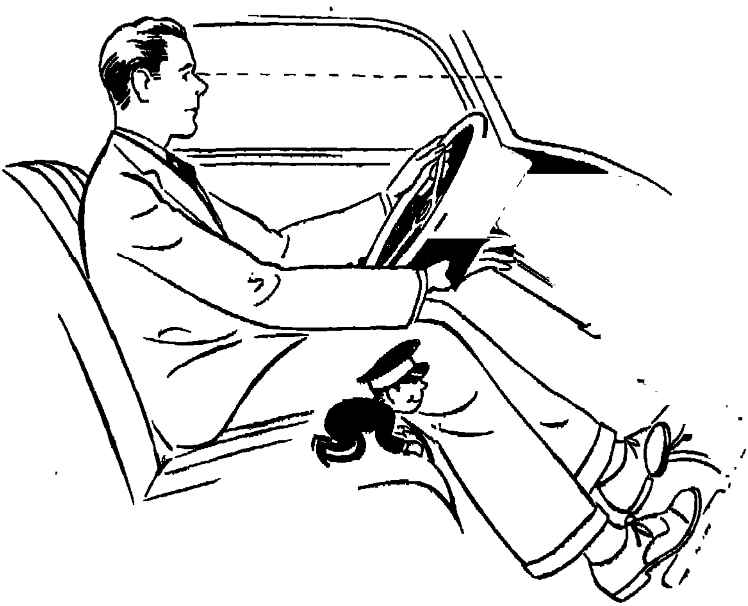


FIG. 166. The expert driver has a "touch system" just as surely as the expert pianist or typist. Note that he has the ball of his foot and not the instep or heel on the clutch pedal.

There is enough gasoline in the tank.

The lights are working—if you are to make a night trip.

ARE *YOU* READY?

Now check yourself.

Are you well acquainted with the gauges, levers, and control devices of your car? Do you know their positions and uses?

You cannot afford to be looking about for pedals, levers, and control devices while your car is moving. Your eyes must constantly watch the road. You should glance at the instrument panel only when traffic conditions permit.

So you must know the position and uses of the pedals and levers perfectly. Sit in the driver's seat and run over them again. Try to find them by "feel." Touch them with the correct hand or foot and review what each one does.

1. Ignition switch......right hand—Turns on electric current.
2. Starter switch.......right or left foot—Makes contact to cause starting motor to crank the engine. (Some cars have a dash starter button.)
3. * Clutch pedal........left foot—You step on it to disengage the clutch so that you can shift gears.
4. * Gear-shift lever.....right hand—You use it to mesh gears when going into first, second, third, reverse, or neutral. On a few makes of cars, the gear shifting is done automatically by the right foot as it presses the accelerator.
5. Accelerator ....right foot—Feeds the gasoline-air mixture.
6. Brake pedal.........right foot—You use it to stop or slow down the car.

7. Hand brake lever....left hand—You use it to hold the car in place after it is stopped. (Some cars have the hand brake grip on the right side of the steering wheel.)
8. Switch button for lights ....right or left hand—Turns on lights.
9. Light control button..left foot—You step on it to lower the headlight beams on meeting another vehicle.
10. Horn button or ring..right or left hand—Sounds the horn.
11. Windshield wiper control button........right hand—Starts the wiper blades.

* NOTE: On cars equipped with fluid-type drive, or automatic or semi-automatic transmission, there may be no clutch pedal or it may be used differently, or there may be no conventional gear-shift lever.

A DEMONSTRATION FIRST

Now it's time to climb in beside the driver who is coaching you. Watch him handle the car. Ask him to do things slowly. Follow every move carefully as he starts the engine, starts the car, changes gears, steers the car evenly, and brings it to a smooth stop.

Does it look complicated? It really isn't. Let him do this for you several times, slowly enough for you to study every move. Have him tell you just what he is doing all the time. If you don't understand why something is done, ask him to explain that step again and to demonstrate it a few more times. Keep a sharp eye on one thing especially—the directions in which his right hand moves in shifting the gear-shift lever.

In driving, it is highly important that you should make the correct gear-shift movements without looking at the lever. So study the diagram (Fig. 167) of the different positions

for the knob on the gear-shift lever, and fix them in your mind before trying to shift gears. Note that the relative positions are the same for both the floor and steering column type of gear-shift lever.

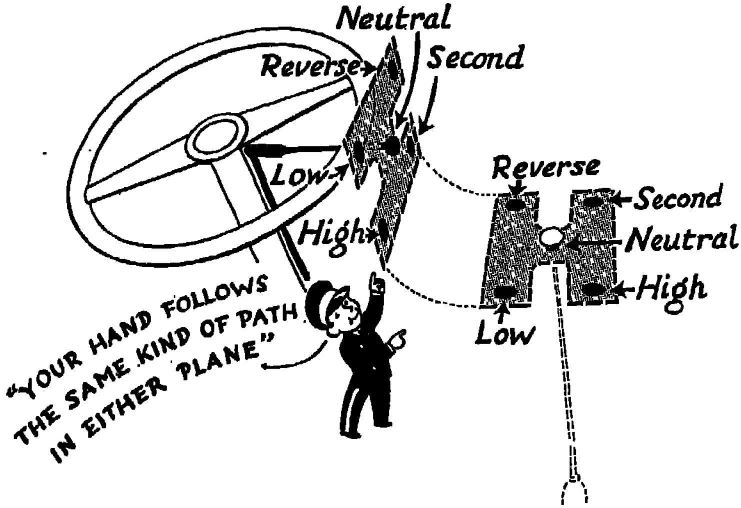


FIG. 167. As you shift gears, imagine that you are holding a crayon sticking out past your hand like an extension of the gear-shift lever. Suppose a sheet of transparent paper or celluloid is touching the crayon. The movements of the crayon, as you shift for the various gear positions, would mark a rough "H." If you boxed in these marks, you would have an "H" as shown above.

You will remember that the gear-shift lever joins or meshes the different-sized cog-wheels in the transmission to give you the various speeds and powers of your car. Study the diagram until, with your eyes shut, you can see the five positions of the knob on the gear-shifting lever—the positions for low gear, second, high, reverse, and neutral.

Notice that the driver *never moves the gear-shift lever without first pressing down the clutch pedal with his left foot.* And notice that he *keeps this pedal firmly pressed down until he has finished shifting the gear-shift lever into a new position.*

The reason is very important. By pushing down the clutch pedal completely, you disengage the clutch. This action dis-

connects the engine from the driving mechanism until you change to gears of a different ratio. If you fail to disengage the clutch fully, there is a loud and indignant roar of protest from the gears. They can even be broken or "stripped" by this clumsy kind of shifting. You have heard the ugly grating noise an inexpert driver makes when shifting gears. For quiet, smooth, gear-shifting, *keep the clutch pedal down.*

BEHIND THE WHEEL

When you are sure of the different positions of the gear-shifting lever, take your place in the driver's seat for a first practice. Be sure to place purse, books, or other articles on the back seat to avoid the distraction and confusion they might cause while you are learning to drive.

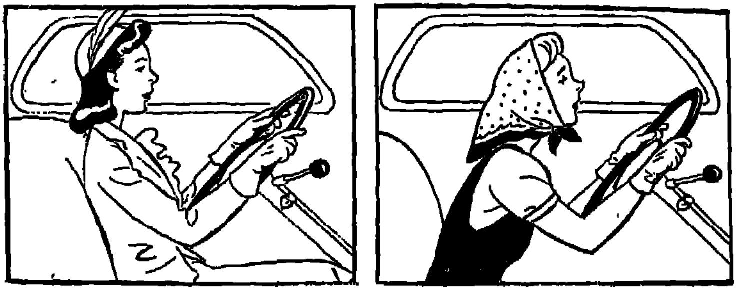


FIG. 168. Proper seat adjustments help make driving a pleasure and prevent the strained position of the driver on the right.

Does the seat fit you? Is it high enough? You must be able to see the road in front of you *over* the steering wheel—not through the spokes. And you must be able to see the road behind you through the rear-view mirror. If necessary, adjust the seat, or use firm cushions, so that you can reach the foot pedals and hand levers easily, without having to strain for them.

The best position for hands on the steering wheel varies with the length of arms of the driver and the position of the seat. The main point is to keep your hands well apart and in a position that will let you exert a strong turning force in either direction with both hands, or with either hand. Naturally your

hands won't remain glued to any one position. You will move them about somewhat. It is generally best to keep the hands on the sides of the wheel rather than at the top or bottom.

Hold the wheel firmly, but don't grip it as if it were struggling to get away!

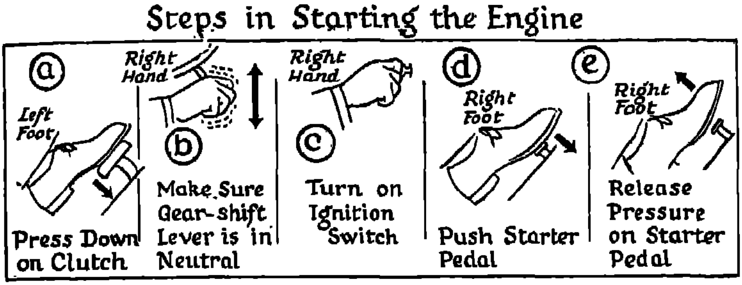


FIG. 169. Practice should make these steps a habit.

The driver should acquire the habit of keeping his feet in a comfortable position, ready to be used on the pedals. In the normal driving position, the right foot is on the accelerator and the left foot is on the floor, not on or underneath the pedals.

Starting the Engine

Now for action!

The rest of this chapter will require several lessons, each one accompanied by careful *road practice* with the instructor. The number of lessons will depend on how fast you learn. Don't be in a hurry. Be sure to *master one step at a time*, and be able to show that you can do each one easily and well before going on to the next.

Let's start the engine. Study Fig. 169. Then:

a. Press down the clutch pedal with the left foot to disconnect the engine from the rest of the car. This is not only the safe thing to do, but it reduces the load on the storage battery. Be sure the ball of the foot rests squarely and firmly on the pedals when you are depressing them. Hold the pedal down firmly during the next steps.

b. Check the gear-shift lever by jiggling it, to see that the gears are in neutral. If they are in neutral, the lever can be moved freely from side to side.
c. Turn on the ignition switch.
d. Push the starter pedal or button firmly.
e. Release pressure on the starter pedal or button *at once* when the engine starts to run. Never touch the starter pedal or button when the engine is running.

The engine is now running, and you can let the clutch pedal up slowly, keeping the gears in neutral. Notice that added pressure on the accelerator speeds up the engine and that releasing the accelerator pedal slows down the engine. To stop the engine, take your foot off the accelerator and turn the ignition key to the "off" position.

Start and stop the engine several times with gears in neutral until it is easy to remember these five steps. If the engine is cold when you want to start it, and if your car is not equipped with automatic choking, you may have to pull out the choke button before you press the starter. When the engine is well started and is getting warm, you can gradually push the choke button back into place. Push it all the way in as soon as the engine will run smoothly without choking. Many passenger cars now have automatic choke devices.

In some cars, the hand throttle button has to be drawn out slightly when you are starting the engine. In warming up the engine, do not run it any faster than necessary to keep it from stalling. As soon as the engine is warm and you can control it with the foot accelerator, close the hand throttle entirely. *The car should not be driven with the hand throttle open.* For any make car, when starting the engine, follow the directions found in the owner's guide.

If the engine does not start after you have used the starting device for five to ten seconds, release the starter and find out what is the matter. Repeated long use of the starter will soon discharge the storage battery. The failure of an engine to start might be due to:

1. Lack of gasoline in the tank.
2. Failure to turn on the ignition switch fully.
3. Too rich or too lean a mixture, as controlled by the choke.

It would probably take a mechanic to remedy more complicated troubles such as:

4. A clogged fuel line.
5. A broken or disconnected wire in the ignition system.
6. Fouled spark plugs:

   If coated with carbon, they must be cleaned.
   If broken, they must be replaced.
   If the points are improperly set, they must be adjusted.

7. Improper adjustments:

   The carburetor choke valve may not close tightly.
   The throttle may not open sufficiently.

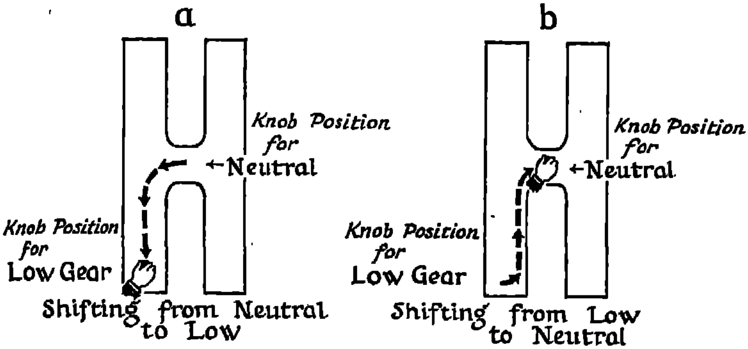


FIG. 170. Practice making these shifts until you no longer have to *think* out what you are doing.

Starting the Car

Now have your instructor pick out a wide, quiet street or road away from traffic. You are going to do a bit of driving—

a. Start the engine, as you have just learned to do.
b. Press the clutch pedal all the way to the floor.
c. With palm up, raise the gear-shift lever toward the steering wheel, and then pull it back toward you into low gear.

The direction is shown by the dotted line in Fig. 170 (a). On trucks, the gear positions are different because there are four or more forward gears. See Fig. 174.

d. Release the hand brake lever, moving it forward as far as possible. Keep your left foot pressed tightly against the clutch pedal all the time.
e. Rest your right foot lightly on the accelerator pedal so that your engine is running a little faster than idling speed.
f. *Slowly* allow the clutch pedal to come up until it reaches the *friction point*, or the place where you can hear and feel the clutch taking hold. Then hesitate an instant and *gradually* let it up farther. At the same time, press *gradually* on the accelerator pedal with the right foot, so that the engine will get enough gas to have power to start the car in motion and increase the momentum. You are harnessing the engine for its work of moving the car, and you must give it gas to do the work. If the car starts with jumps or jerks, the clutch pedal has not been released properly. It may have been released too fast or too far. If this happens, press the clutch pedal down immediately and start releasing it again until you start the car smoothly.
g. Increase the pressure on the accelerator pedal to get more momentum.

Your car will now be moving in first, or low gear, and you face the problem of steering.

Steering

Keep your eyes on the road, even when using the pedals and levers. Keep your hands in the position recommended by your instructor.

Steering is not difficult. Observe that *the car moves in the same direction in which you turn the wheel.* If you turn the wheel clockwise, or to the right, the car will turn to the right. If you turn the wheel counter-clockwise, or to the left, the car will turn to the left. See Fig. 171.

At first, you won't know how far to turn the steering wheel to make the car go just where you want it to go. The car

may seem to display a tricky tendency to land you in the gutter! But practice will give you judgment.

Practice until you know exactly where the wheels of the car will go. The beginner usually turns too far and too suddenly. Practice will soon correct this.

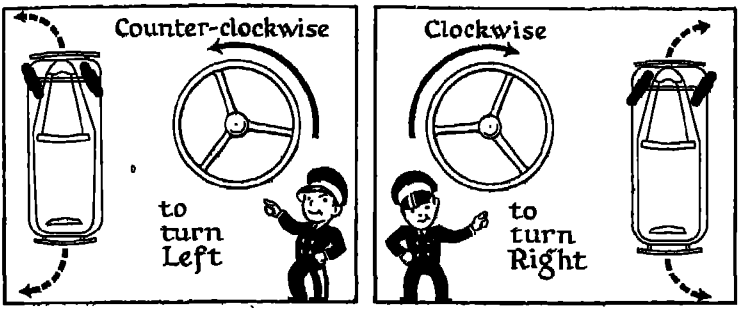


FIG. 171. Turn the steering wheel *counter-clockwise* to go to the left—whether it is going forward or backward, and *clockwise* to go to the right.

Begin at once to *drive on the right side of the road.* This is so important that the habit should be formed during the very first trial at the wheel.

Keep your eyes on the road.

Stopping the Car from Low Gear

You are driving along in low gear, and you want to stop the car. This is what you do:

a. Press the clutch pedal with your left foot, disengaging the clutch.

b. Take your right foot off the accelerator, cutting off the feed of gas to the engine. Learn to do this at just about the same time that you are pressing down on the clutch pedal. There should be a slight lag in taking your foot off the accelerator when in low gear to prevent a jerky motion.

c. Move the right foot to the brake pedal and *press on it slowly and with a smooth, gradual increase until the car has almost come to a full stop.* Then release the brake pressure a bit for smooth stopping.

d. Shift the gears to neutral, following the dotted line shown in Fig. 170 (b). Keep the gear-shift lever in the neutral position until you are ready to start again. This practice is recommended at all times and is especially important at traffic lights, stop signs, and places where there are pedestrians.
e. Take your left foot off the clutch pedal, but keep pressure on the brake pedal.

Shifting from Low to Second Gear

When you can start the engine skilfully, and have practiced several times starting the car in first or low gear and bringing it to a stop, you are ready to learn to change from low to

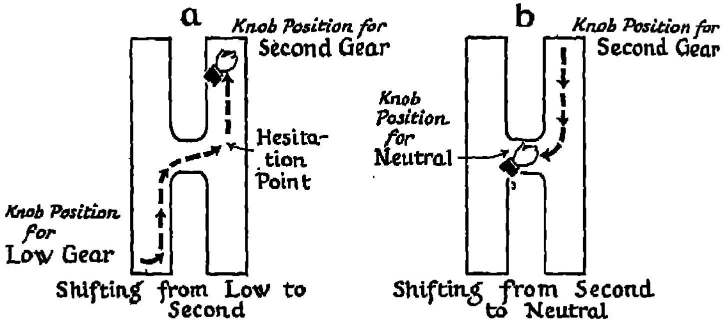


FIG. 172. The indicated paths of the gear-shift lever knob should be followed smoothly and easily. Note the "hesitation point." A slight hesitation at this point avoids clashing of the gears and gives you smooth, quiet gear-shifting.

second gear. Start the car as you have learned to do. When it is running smoothly in low gear, *keep eyes up* and—

a. Press the accelerator until the car is running approximately eight miles an hour, or fast enough to be able to run on momentum during the change of gears.
b. Press the clutch pedal all the way to the floor with the left foot and take the pressure off the accelerator at almost the same time.
c. With palm down, move the gear-shifting lever forward to

the position of neutral; then tilt it away from the steering wheel and forward into second gear. In moving forward, use a slight pressure on the gear-shift lever away from the steering wheel, so that the lever will by no chance move past the neutral position and into reverse position. Follow the dotted path shown in Fig. 172(a). Notice the hesitation point, and practice observing it.

d. As soon as the second speed gears are engaged, do two things almost simultaneously:

   1. Allow the clutch pedal to come up smoothly and not too rapidly, stopping for an instant at the friction point. This engages the clutch properly.
   2. At the friction point of the clutch, gradually press the accelerator pedal.

You are now driving in second gear and should be carefully steering the car *on the right-hand side of the street.*

To bring the car to a stop from second gear, proceed as you did when bringing it to a stop from first or low gear, except that you will move the gear-shift lever to neutral in the direction shown by the dotted line in Fig. 172 (b).

Practice until you can skilfully shift from first to second and stop from second gear. Then you are ready to learn to shift from second into third, or high, gear.

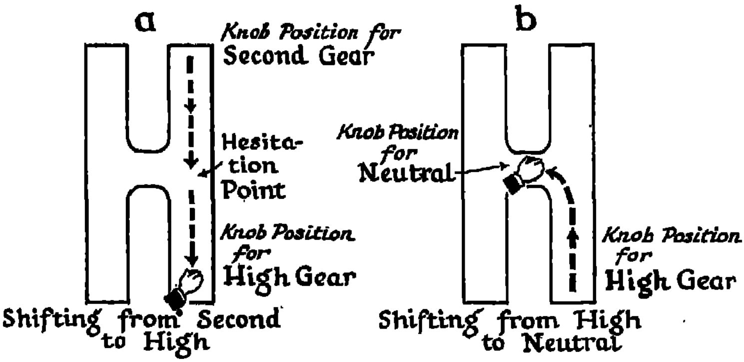


FIG. 173. The gear-shift lever knob is pulled back in a straight path when shifting from second to high gear.

Shifting from Second to High Gear

Proceed as above until you have the car running smoothly in second gear. Then, *with eyes up:*

a. Press gradually on the accelerator to get up a little momentum. Your car must have sufficient speed—approximately 15 miles an hour—to carry it along while the engine is disengaged during the shifting of gears, and to keep it from laboring when in high gear.
b. Press the clutch pedal all the way to the floor and take the pressure off the accelerator at the same time.
c. With palm down, move the gear-shift lever straight back past neutral to third, or high speed position, as shown on the direction line of Fig. 173 (a). Notice the hesitation point and practice observing it.
d. As soon as the third speed gears are engaged, do two things almost at the same time:
   1. Allow the clutch pedal to come up smoothly.
   2. Gradually press the accelerator pedal in order to continue in motion and to gain momentum.
e. Remove the foot from the clutch pedal.

Now you are driving the car in high gear. You will find the steering easier. You will learn also to make smaller turns of the steering wheel. For, at higher speeds, shorter turns of the steering wheel are needed to change the course of the car. Practice until you know just where the wheels of the car will go with different turns of the steering wheel. *Keep to the right side of the practice street.*

Stopping from High Gear

To stop from high gear, proceed as you learned to stop from other gears, with these exceptions:

a. Use the foot brake before you press down on the clutch. When the car is in high gear, the engine can help to slow down the car. As you take your foot from the accelerator, the engine slows down and decreases the speed of the car. You won't want to lose this braking power of the engine by disengaging the clutch too soon.

b. When the speed of the car has been reduced to approximately 10 miles per hour, press down on the clutch pedal. Continue pressure on the brake pedal until the car has come almost to a full stop; then release the pressure a bit to avoid a jerky stop. After the car has completely stopped, keep pressing on both pedals.
c. Move the gear-shift lever directly to neutral, in the direction indicated in Fig. 173 (b).
d. Release the clutch pedal until you are ready to start again.

General Features of Gear-Shifting

The shifting of gears is an operation requiring smooth timing and a delicate sense of the needs of your car—a sense of the relation between the speed of your engine and the speed of your car. This sense comes with careful practice.

For smooth starting and gear-shifting, learn to sense the *friction point of the clutch*, or the point, as you learned on page 234, where you *feel* and *hear* the clutch first taking hold.

Drivers who start smoothly and shift gears noiselessly and smoothly, without jumping the car, stalling the engine, or grinding gears, have learned to sense this friction point and have the habit of using it.

At the very instant you reach the friction point and your car is starting to move, press very lightly on the accelerator pedal. Then, as you bring the left foot on up and fully engage the clutch, gradually feed more gasoline.

If you feed gasoline too soon, or before the exact friction point is reached, your engine will be running too fast and

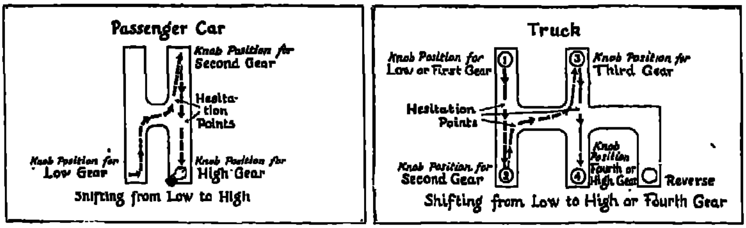


FIG. 174. Use all forward gears when starting a motor vehicle from rest.

will give a quick jerk to the car. If you feed gasoline too late, or after the friction point has been reached, the engine will not have enough speed and power to pull the car and there will be a series of slow, bumpy jerks or even a stalled engine.

Learning to use this friction point skilfully is one of the secrets of expertness in driving.

The process of shifting the gears all the way from low to high, for both passenger cars and for trucks with four forward gears, is summarized and diagrammed in Fig. 174. Study the position of the hesitation points. Hesitating at these points will help you make shifting smooth.

Observe also the following practices which tend to make gear-shifting skilful:

1. Keep the left foot poised on the clutch pedal until you have completed the shifting procedure.
2. Keep the right hand on the knob of the gear-shift lever until you have completed the gear-shifting procedure. Only the "dud" driver transfers his hand to the steering wheel between steps.
3. Attain a speed of approximately 8 miles an hour in low gear before shifting to second.
4. Attain a speed of approximately 15 miles an hour in second gear before shifting to high.

The complete operation of shifting from low through second to high gear should, under ordinary conditions, be completed in about 12 seconds and within a distance of about 175 feet.

Shifting from High to Second Gear

Sometimes, when you are driving on hills or are slowed down in traffic, it is necessary to shift from high gear to second. Never hesitate to shift into second, if you feel that you can keep your car in better control by doing so. Shift on hills when it is evident that the engine is laboring under its load.

When shifting from high to second, greater engine speed is needed to match car speed. If the change has to be made, this is how it is done:

a. Release the pressure on the accelerator, and simultaneously,
b. Press down on the clutch pedal.
c. Shift from third gear to second, reversing the direction shown in Fig. 173 (a).
d. Press on the accelerator pedal to increase the speed of the engine, because second gear requires a faster engine speed than high gear. Only practice gives you the feel of the proper engine speed.
e. Release the clutch pedal *at the same time* that you press the accelerator pedal.

If your car is climbing a hill during this shift from high to second, the shift must be made smoothly and quickly enough to maintain momentum and avoid a "stall." A shift from high to second should generally be made only when the speed of the car has dropped to from 15 to 20 miles per hour.

Sometimes a *downgrade* proves steeper than it looks. Perhaps a shift to second should have been made *before* starting down. But the shift was not made, and now the problem is how to make it while on the downgrade. The procedure is the same as in shifting from high to second on an upgrade, except that, immediately after step "a", you apply the foot brake to slow down the car and allow a smooth shifting of gears. Here, again, you need practice to make the shift smoothly and easily.

The shift from high to second gear is sometimes necessary when:

1. On a very steep upgrade, or downgrade.
2. On any upgrade where it is necessary to slow down behind slow-moving traffic.
3. In very heavy, slow-moving traffic, even on the level.
4. Entering and crossing busy or blind street intersections.
5. Preparing to make sharp turns.
6. Preparing to cross railroad tracks on an upgrade.

"Double-clutching" in Shifting from Second to Low Gear

Sometimes, when you are driving behind a truck, when you are slowed down in traffic, or when a downgrade is especially steep, it is necessary to shift from second to low gear. In order to perform this maneuver correctly and without danger of clashing gears, you must follow a somewhat different procedure from that used in shifting from high to second.

Whenever a car is shifted to a lower gear, the engine must be speeded up. On most of the modern cars, an ingenious synchronizing mechanism makes it possible, when you are shifting from high to second, for the gears to engage without clashing. It is still important, however, to speed up the engine before re-engaging the clutch, to prevent a jerk when the clutch is released.

Sometimes, in shifting from second to low, you may have to use a procedure known as "double-clutching." On heavy trucks and buses, "double-clutching" is always necessary in shifting gears. "Double-clutching" is done as follows:

a. Press down on the clutch pedal.
b. Shift to neutral.
c. Let up on the clutch pedal.
d. Press down on the accelerator. (This action speeds up all the gears in the transmission, except those mounted on the shaft which transmit power to the driving wheels. Engine speed should be comparable to speed when driving in low gear.)
e. Press down the clutch again.
f. Shift to lower gear.
g. Release the clutch pedal slowly.

When you are "double-clutching" going downhill, you must speed up the engine much more than when "double-clutching" going uphill. The reason is that the car is moving more rapidly on a downgrade, and so the engine must have greater speed to accomplish a smooth, quiet changing to low gear.

This action is a particularly difficult maneuver for beginners. Hence it is safer for the beginner to stop the car before attempting to shift into low gear.

PRACTICE

Much well-guided practice away from traffic will bring results. Practice the simple, straightforward driving operations described in this chapter until they are easy. When you can start the car with ease and confidence, shift the gears smoothly, and bring the car to a stop at the exact spot where you want it to stop, you are ready for the more complicated driving maneuvers.

DISCUSSION TOPICS

1. What possible checks on the car, other than those suggested in the text, should be made before taking it out?
2. Discuss possible consequences of acquiring the bad habit of watching the movements of your hands and feet when using pedals and levers.
3. Explain just why you must *never* shift gears without disengaging the clutch and keeping it disengaged until the shift is completed.
4. What is the most suitable kind of street or road for a beginner's first lessons in driving?
5. Explain why, during the shift from low to second and from second to high, the car must be going fast enough to run on momentum during the shift.
6. If the gear-shift lever is hard to "jiggle" when in the neutral position, how would you make sure that it is in neutral?
7. Why is it sound practice to depress the clutch pedal when starting the engine?
8. When stopping the car in low gear, why should you step on the clutch pedal before applying the brake?
9. Discuss the ill effects of holding the steering wheel rigidly.

PROJECTS

1. If possible, examine exposed transmission gears to see just how the shifting through neutral to the four gear positions is done. Then study the diagrams in this chapter to link them up with your observation of the actual gears.
2. Make a list of circumstances which would cause a good driver to do each of the following things:
   a. Keep his left foot on its heel in readiness to move instantly to the clutch.
   b. Release the accelerator and poise his right foot above the foot-brake pedal.
   c. Move his hand just enough toward the horn button to be able to press the button in a split second.

d. Make especially sure that his hands are in a good position to turn the wheel quickly in either direction.

3. Decide on and chalk-mark the *exact* spot in the road where you intend your right, or your left, front wheel to pass. Practice until you can drive over this spot accurately. You may have heard how expert tennis players practice hitting the ball at a fixed target like a handkerchief placed on the court. The same kind of practice develops skill and confidence in driving a car.
4. Decide on and chalk-mark the *exact* spot where you intend bringing the front of your car to a stop. Practice stopping until you can do this *accurately*.

FOR FURTHER READING

Owner's Manual. Published by all automobile manufacturers and obtained from automobile dealers.

The Operation of an Automobile. Laporte, Rudolph J. Bruce Humphries, Inc., Boston, Massachusetts. 1932. 64 pp.

CHAPTER XV

Maneuvers

Do You Know:

The proper techniques for:

- **Backing a car?**
- **Making right and left turns?**
- **Turning a car around?**
- **Parking?**
- **Starting on an upgrade?**

GOOD FORM IN DRIVING

WATCH FIFTY first-class golfers tee off and you are impressed by one thing—the great majority of them have nearly the same driving form. They take much the same position and go through much the same motions in hitting the ball. Indeed, this is one of the reasons why they are first-class golfers. In driving a golf ball, certain *practices* produce good shots.

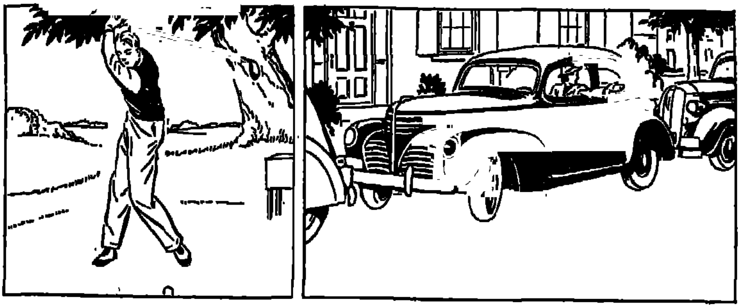


FIG. 175. In driving, as in golf, certain good habits produce good results.

The same thing is true in driving an automobile. Certain ways of handling a car produce the best results. Failure to follow these ways marks the "dub" driver just as surely as failure to observe rules and principles in golf marks the "dub" golfer.

BACKING THE CAR

When a poor driver gets into a tight place and has to turn his car around or park it in a narrow area, his lack of driving skill sticks out like a sore thumb! He embarrasses himself and everybody in the car.

"Why doesn't the fellow learn how to drive?" That's what spectators say or think.

The sensible questions are: How did he learn to drive? Why is he so clumsy in parking and turning? He must have had no competent instructor to show him the fine points of driving. He must have "muddled along" learning to drive as best he could. Obviously he never mastered *backing the car*. Two important maneuvers, turning around and parking, require skill in backing.

Backing a car requires control. A certain amount of control depends on a skilful use of the friction point of the clutch —the point at which the car just begins to move.

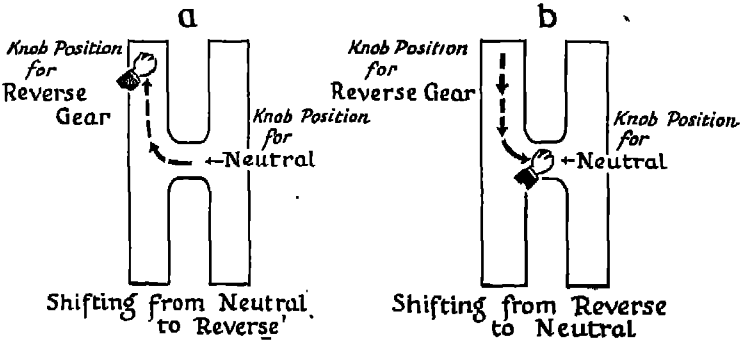


FIG. 176. Reverse gear is used in backing the car.

When you are maneuvering the car in narrow places, or under circumstances where it must be just barely moved, your foot should hold the clutch at this friction point. By doing this, you keep your car very carefully controlled and can stop it almost instantly, if necessary. Use this friction point of the clutch when backing your car.

For practice in backing, pick out a street free from other vehicles and pedestrians. Sit beside your coach and watch him shift into reverse, start the car slowly backward, and bring it to a stop. Have him repeat the maneuver several times.

Notice especially how he uses the clutch pedal. He releases it very gradually, not allowing the pedal to come all the way up. He uses the friction point of the clutch to control the speed of the car. He keeps his foot on the clutch pedal in order that the car can be stopped instantly if necessary.

Notice, too, that he always brings the car to a full stop before making a shift into reverse gear. The shift is always *from neutral* to reverse.

Now take the wheel. Then, *with eyes up,* after making sure the road is safe for backing, both ahead and behind, practice shifting into reverse yourself:

a. Press the clutch pedal down.
b. With palm up, raise the gear-shifting lever toward the steering wheel. Then press it forward into reverse gear, following the direction shown in Fig. 176 (a).
c. *Slowly* allow the clutch pedal to come up to the friction point.
d. At the same time, gradually increase pressure on the accelerator pedal. Keep the clutch pedal at the friction point so that you can back the car smoothly and slowly without "killing" the engine. The novice tends to feed gas too quickly and then release the accelerator too suddenly in an effort to correct his error. Try to avoid doing this.

You are now moving in reverse and have the responsibility of steering while the car is going backward. The car will turn in the same direction in which you turn the top of the steering wheel, just as it did when steering forward. If you turn the wheel to the right, or clockwise, the back of the car will go to the right; if you turn the wheel to the left, or counterclockwise, the back of the car will turn to the left.

How can you watch the path of the backing car? This depends on circumstances. If you are maneuvering the car into

a narrow place, or close to the edge of the roadway, or around a turn, looking into your rear-view mirror is not sufficient. Watch the road either by leaning your head slightly out the side window or by looking back over your right shoulder and watching through the rear window. Also observe how far out the front end of the car swings. Practice this maneuver slowly and many times. Always be ready to bring your car to a quick stop.

Bringing your car to a stop from reverse requires the following familiar steps:

a. Press the clutch pedal down.
b. Remove the right foot from the accelerator as you push the clutch pedal down.
c. Apply the foot brake to stop the motion of the car.
d. Shift gears to neutral, following the direction shown in Fig. 176 (b).

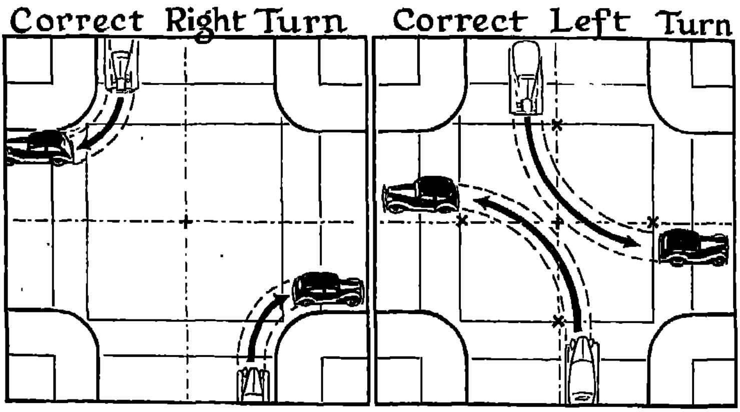


Fig. 177. Do the practices in your community conform to these?

TURNING CORNERS

Your road practice, to this point, has consisted of driving straight forward or straight backwards. Now you must add the experience of turning corners.

Right Turns

While you are learning, right turns can be made most easily in second gear.

When making a right turn, first make sure that your car is in the proper lane—three to five feet out from the curb. Then you face the problem of *when* to start turning the steering wheel. If you start too soon in a right turn, the rear right wheel will go up over the curb. If you start too late, the car will be out too far in the wrong lane when the turn is completed. As a general rule, the turn is started when your front wheels are opposite the point where the curb begins to curve.

Have you noticed the "dub" driver who goes around corners turning the steering wheel a few inches at a time in a series of jerky movements with both hands? He has not learned a *hand-over-hand* technique.

FIG. 178. Skilled drivers turning sharp corners use a hand-over-hand technique.

Smooth steering around corners calls for this hand-over-hand technique, as illustrated in Fig. 178. One hand or the other always retains a firm hold on the wheel and, at the same time, applies turning power to it.

As the turn is being completed, your hands slide along the steering wheel to their normal driving positions while the wheel itself is permitted to slip through them. The wheel slips

through your hands on the newer cars because the mechanism of the front wheels gives them a tendency to return to their normal, straight-ahead position. The speed of the return is controlled by the pressure of your hands on the steering wheel and the speed of the car. The final alignment of the wheels is made by your hands. On some older cars, and on new cars at slow speeds, or on snow and ice, it is necessary to reverse this hand-over-hand procedure in order to return the front wheels to the normal straight-ahead position.

Left Turns

Start left turns from the lane nearest the middle of the street and at the time when the front wheels pass through the pedestrian crosswalks. If you start to turn too soon in making a left turn, you cut the left-hand corner and get into the path of vehicles coming from the left. If you turn too late, you interfere with vehicles coming from the right or with the traffic turning left from the opposite direction. You should not start a left turn until after all approaching traffic near enough to interfere with the turn has passed.

TURNING AROUND

If you can now change easily into low and reverse gears, bring your car to an easy stop from both low and reverse, back, and turn corners, you are ready to tackle the job of *turning the car around.*

Two methods of turning around are illustrated in Fig. 179. Study the direction paths well, and practice these two techniques. Backing a car is prohibited in some places.

Driveways, alleyways, or farm lanes, as well as side streets, can be used to great advantage in this type of turning around.

Method A is preferred to method B because it avoids backing into a main roadway. Always avoid backing across main highways and main streets. In many places the law forbids it.

In using either of these turning maneuvers:

1. Choose places where there is little or no traffic.
2. Avoid backing into main highways and main streets.

3. If possible, avoid backing downgrade or toward a steep ditch.
4. Look carefully to see that your path is perfectly clear.
5. By sounding your horn, signal your intention to back.
6. Move the car slowly.
7. Hold the clutch near the friction point.

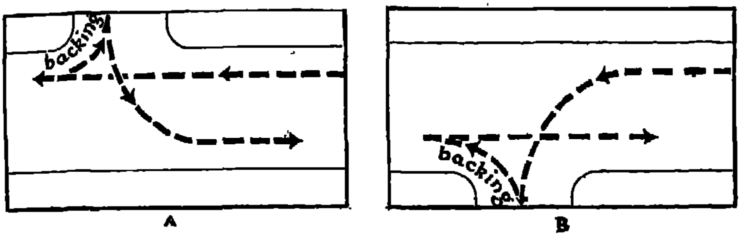


Fig. 179. The arrows indicate the paths of a car in two different methods of turning around where there is a side street or alley. Except where otherwise marked, the car is moving forward.

U-Turns

Occasionally you will want to turn in one complete sweep. Before you do this, be sure it is in a place where U-turns are permitted. In many places they are illegal.

In the country, be certain that the spot is far enough away from hillcrests or curves to insure that cars will not come upon you suddenly from a short distance away. In the city, make sure that no vehicles, pedestrians, playing children, or animals can get in your way. Even when you are satisfied that your way is clear, be alert and ready to stop your car instantly.

Here are the steps for making a U-turn:

a. Give hand signal for stopping.
b. In cities, stop at right-hand curb. On the highway, stop, if possible, on the shoulder off the pavement. If on a street that is wide enough, however, start your left turn from the lane next to the center line.
c. Look carefully for other vehicles. If in the middle of the block, look ahead and behind. If at an intersection, look carefully in all directions.

d. Give hand signal for a left turn.
e. Proceed cautiously, making a left about-turn in low, or second, gear.
f. Begin straightening the car as soon as the turn is completed.
g. Bring the car into final position smoothly, without weaving.

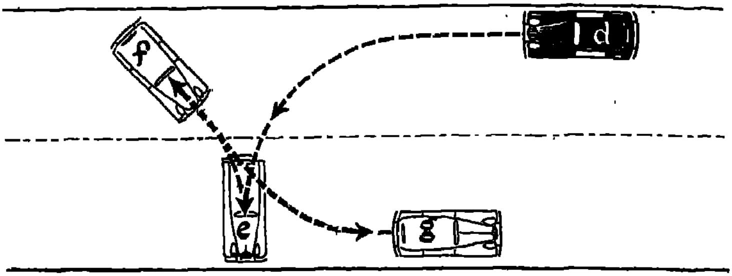


Fig. 180. Make this turn only when there is no approaching traffic.

Turning Around in the Width of the Street

Turning around in a narrow street is *always* hazardous. These are the steps for turning around in a narrow street:

a. Stop the car as close to the right-hand edge of the pavement as possible.
b. Be sure that the way is clear both ahead and behind.
c. Give the signal for a left turn.

The next four steps are illustrated in Fig. 180.

d. Go forward in low gear. Turn the steering wheel to the left as far and as fast as necessary to bring the car to position e. Keep signalling for a left turn.
e. When the front wheels are about two feet from the curb and the car is still moving very slowly, start turning the steering wheel to the right.
f. Back the car slowly, turning the steering wheel to the right as far and fast as is necessary to bring the car into position f. Stop when the car has been turned far enough to permit the final movement to be made, or when the rear wheels are about two feet from the curb.

g. Go forward in low gear, turning the steering wheel to the left. If this step does not bring the car into correct position on the right side of the road, shown in position g, repeat steps e and f as many times as are necessary to bring the car into position g.

In some states, the driver's license examination requires you to demonstrate turning in the width of the street without touching the curb either in backing or in going forward.

The turning method you use at any time depends on such circumstances as traffic and the width and layout of the street. Choose the method which causes least traffic interference and which permits clear, unobstructed vision.

Turning around is not permitted on some streets because it is hazardous and because it might delay traffic. Many times the simplest and best means of turning around is to drive around the block.

PARKING

The other maneuver which, like turning a car, requires skill in backing is that "Waterloo" of many drivers—parking in a limited, or marked off, space at the curb. Someone has paraphrased an old saying to read, "Show me how well you park and I will tell you how well you drive."

There is a certain amount of truth in the saying. A driver who parks well has learned to control his car. He can judge space and can put his machine just where he wants it.

Do your first practice parking away from traffic. You can set up barrels, sawhorses, or cartons to represent parked cars at each end of the space into which your car must be parked. Every time you hit a barrel in practice, it scores as one bent fender against you!

Here are some simple instructions. Study them and *practice* them carefully until you are able to park your car with confidence. Skill in parking is a great asset to a driver.

Angle Parking

In some cities, angle parking is used in order to get more cars into a given curb length. Angle parking may be "head

in" or "back in" parking. Both are simple operations, but require several sound driving practices. Before you enter a "head in" parking space:

a. Observe traffic conditions both ahead and behind.
b. Signal your intention of slowing down.
c. Move your car to the left at least five feet to get into position to clear other parked cars when entering the parking space.
d. Steer sharply to the right, centering your car in the parking space.
e. Continue forward slowly until the front wheel touches the curb lightly.
f. Place the gear-shift lever in reverse position, pull on the hand brake, turn off the ignition switch, turn out the lights, roll up the windows. Lock the car, after you are sure you have taken the keys with you.

In coming out of a "head in" parking space, move slowly and with great care because you cannot easily see approaching traffic. Be sure no car is approaching close in the lane into which you are backing.

As a signal to other traffic, make a stop after backing about four feet. Continue backing until your left front wheel passes the rear bumper of the car parked to the left. Then turn the steering wheel sharply to the right, and straighten the wheels quickly when the car is parallel to traffic.

Entering a "back in" parking stall is more difficult. But it is much less hazardous to drive out of such a stall than out of one where "head in" parking is used.

Drive slowly about half a car length past the space, and signal your intention to stop. Then, when traffic permits and you are sure nobody is in your path, start backing *slowly*, turning the steering wheel to the right, or clockwise, as far and as fast as necessary to place the car in position to back straight in. Ease in very slowly until the rear wheel just touches the curb.

Parking in a Short Curb Space Between Other Cars

Learn, first of all, to judge whether or not the space left along the curb is sufficient for parking your car. A rough rule is that you need *about six feet more than the overall length of your car.*

Assume that in Fig. 181 your car is number 1 and you are going to park between cars 2 and 3. Then take these steps in order:

a. Make sure that the road is clear both ahead and behind. Signal your intention to stop.

b. Drive alongside the car you are going to park behind, (car 2), and stop when the rear bumper of your car is beside the rear bumper of car 2. Your position should be from one to two feet away from car 2. This beginning position is extremely important.

c. Back slowly—slipping the clutch—while turning the steering wheel sharply to the right until your car is nearly at a 45 degree angle with the curb. If your wheels were turned sharply to the right from the beginning of the

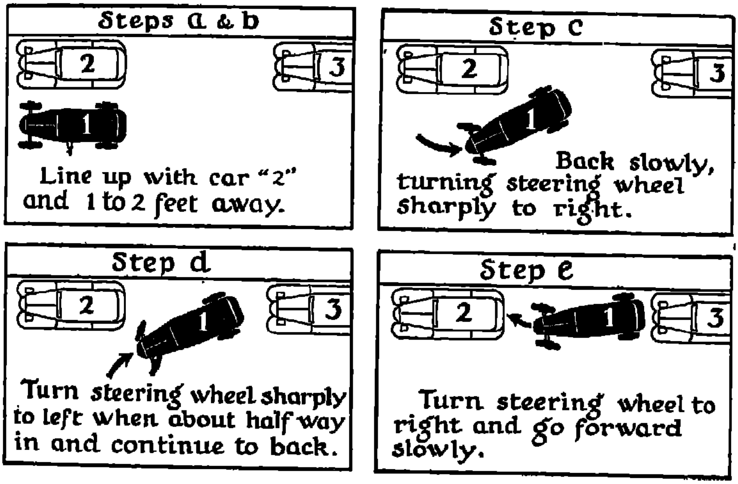


FIG. 181. Follow these steps carefully and park with skill.

backing movement your right front door should now be opposite the rear bumper of the car behind which you are parking. Then straighten the front wheels, and continue backing into the parking space.

d. Continue backing until the right end of your front bumper is about opposite the left end of the rear bumper of car 2. In this position the left rear wheel of your car is about a foot farther from the curb than the left wheel of car 3. Hesitate an instant, and then turn the steering wheel rapidly to the left as far as it will go while backing slowly into the parking space.

e. The rear wheel should now be close to the curb, but should not touch it. Then go forward slowly, turning the steering wheel to the right to bring the car parallel to the curb. Stop the car an equal distance from cars 2 and 3. Most parking regulations require that cars be parked not more than six inches from the curb.

If you are too far away from the curb, you have failed to carry out some maneuver properly. It is generally best, in that case, to swing the car carefully out and follow steps a, b, c, d and e again. Or, if you have enough space in front of your car, you can get nearer to the curb by going forward slowly, turning the wheel first to the right, then to the left, and finally by backing parallel to the curb. It is not wise to park too close to the curb, however, for that practice makes it difficult to get your car out of the parking space, and there is a danger of scraping fenders on high curbs.

f. Put gear-shift lever in reverse position; pull on the hand brake; turn off the ignition switch; turn off the lights; roll up the windows, and lock the car, when you are sure you have taken the keys with you.

This is the parking problem that is faced every day by the average driver in every community. Practice parking until you are skilful and confident; then you need not hesitate to park anywhere.

Pull out from the parking space by reversing the steps described above, except that the first step should be to back the car until it almost touches the bumper of car 3.

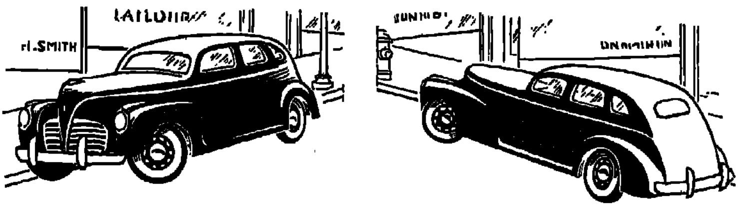
Be sure to *look carefully to see what the traffic conditions are* before you move your car from parking. The chief responsibility for avoiding a collision lies with the driver of the car who is leaving a parking space.

If the street is carrying a fairly dense stream of traffic, wait for a gap in the traffic. If there are no gaps, you must make a break into the traffic stream. Do this by "nosing" out into the stream, little by little, signaling your action all the time to be certain that it is noticed. Give approaching drivers time to see what you are doing and adjust their actions to yours. Finally some car will stop or slow down to permit you to enter the stream.

Turn your car out into the street no more sharply than is necessary to clear the car ahead. As soon as it has cleared, straighten it out, in order not to interfere with traffic in more than one lane.

Parallel Parking on an Upgrade

To park safely on an upgrade, bring your car to the curb, either by driving it directly there, if space permits, or by maneuvering it into position, as you have just learned to do. Turn the steering wheel to the left until you bring the right front tire against the curb. See Fig. 182. This position safeguards the car against moving backward downhill. For the



Downhill **Uphill**

FIG. 182. Note the positions of the front wheels. The curb prevents the car from moving if the brakes slip.

same reason, leave your car *in reverse gear* and with the hand brake pulled on hard.

Parallel Parking on a Downgrade

If you must park on a downgrade, turn the front wheels to the right, as indicated in Fig. 182. Also, leave the car *in reverse gear* and with the hand brake pulled on hard.

STARTING ON AN UPGRADE

What would you do if you were stopped in traffic partially up a hill? How would you get your car going forward again when the traffic light changed, or when the traffic ahead of you started? If not handled correctly, a stopped car displays an exasperating determination to roll backward down the hill!

The best method is to use the hand brake and the accelerator in combination. See Fig. 183. Here are the steps:

a. Pull on the hand brake.
b. Depress the clutch and shift to low gear.
c. Press the accelerator pedal, and *at the same time* slowly release the clutch to the friction point, release the hand brake, and feed more gas so that your car can start forward. Let the engine pull slightly against the brake, however, until the clutch is fully engaged.
d. Continue in low gear until your car has gained enough momentum to permit you to shift to a higher gear.

If your engine stalls on an upgrade, apply the foot brake quickly, depress the clutch, shift to neutral, and pull on the hand brake. Then start your car by stepping on the starter and following steps b, c, and d in the list above.

The procedure for starting to back up a grade is exactly the same as the four steps listed above, except that the car is in reverse gear.

Follow the same method when starting from a parked position on an upgrade, especially if there is no curb.

To avoid the panicky feeling of being stopped or stalled in traffic on an upgrade, before you are sure you can handle the situation, practice the method described above, away from traffic, until you have developed skill and confidence.

On some makes of cars, this problem has been simplified by devices which prevent the car from rolling backward when stalled on an upgrade.

There is another method of starting on an upgrade. It involves using the hand throttle and the foot brake. This method is not so frequently used as the one described.

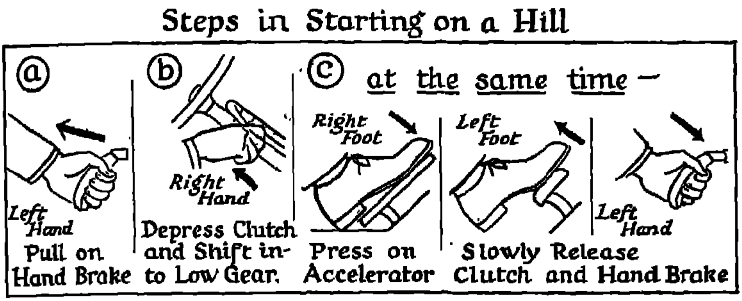


FIG. 188. Starting on a hill requires use of hands and feet together.

ARE YOU READY TO DRIVE IN TRAFFIC?

If you have mastered each step described and have practiced until you have confidence and skill, you can now easily start the engine, start in low gear, shift to second and high, stop from any gear, back the car, turn corners properly, and turn around when necessary. You can start the car on an upgrade and park skilfully in a line, at an angle between other parked cars, on the level, or on an up or downgrade. If you can demonstrate skill in these operations away from traffic, you are ready for the best experience of all—your first drive in regular traffic.

First drives in traffic must always be done with the instructor-pilot sitting by the learner's side. The learner is particularly fortunate if he is privileged to make these first drives in traffic in a real learner's car properly equipped with dual controls like a learner's plane.

Not until doubts and fears about ability to control the car are gone, and skill and confidence have taken their places, is

the risky learning stage entirely over. Not until you have acquired sound habits and know *exactly* how to handle the car in traffic, are you ready for your driver tests. Then, if you pass your tests with ease, you are ready to drop the extra pilot. You can now do "solo driving."

DISCUSSION TOPICS

1. In what direction must the steering wheel be turned to back to the right?
2. Discuss the need for a thorough knowledge of starting and stopping an automobile before learning how to turn it around.
3. In driving an automobile, you are approaching a side street on the right and wish to turn completely around. Describe the methods you can use. Describe a method, assuming the side street is on your left.
4. Explain the best method of starting your car on an upgrade after stalling your engine. Why is this method generally preferred?
5. You are taking your driver's test. You are told to turn around in the middle of the block. Describe and illustrate how you would make the turn.
6. Give specific reasons why you must exercise the greatest care with *any* method in turning a car around on a street.
7. Explain why it is advisable to leave your gear-shift lever in the "reverse" position while parking on a downgrade; on an upgrade.
8. Explain the proper position of your car at a stop intersection if you wish to make a right turn; a left turn.
9. Describe the routine you would follow in parking your car in line between two other cars.
10. What details should you attend to before leaving a parked car?
11. In what position should you place your front wheels when parking on an upgrade?
12. How should a driver signal his intention of backing?

PROJECTS

1. Draw diagrams illustrating the paths of traffic which would be crossed in making a "U" turn (a) *between* intersections and (b) *at* an intersection. Make it clear why a "U" turn is prohibited in many places.

2. Draw a design for a practice street, for driver training purposes, which will include crosswalks, center lines, angle parking lines, parallel parking lines, and such signs as Caution, School Zone, Stop, Right Turn, Railroad Crossing, etc.
3. Paint on the practice roadway a line 175 feet long and 4 inches wide, and then test your skill in knowing the car position by running forward and backward—first keeping both left wheels on the line and then keeping both right wheels on the line.
4. Study the hand positions used by at least a dozen persons in holding the steering wheel while backing.

FOR FURTHER READING

Sense and Safety on the Road. Stoeckel, May, and Kirby. D. Appleton-Century Company, Inc., New York City. 1936. 304 pp.

The Operation of an Automobile. Laporte, Rudolph J. Bruce Humphries, Inc., Boston, Massachusetts. 1932. 64 pp.

CHAPTER XVI

"Solo Driving"

Do You Know:

Whether you are fully ready to solo drive?
Under what conditions driving can be called sound?
How you can achieve smoothness in your driving?
What good sportsmanship in driving means?

SOUND SOLO DRIVING

WHEN YOU start solo driving you will want to be sure that your driving is *sound.*

Sound driving is a more complicated matter than just managing somehow to arrive at your destination. *How* did you get there? What happened on the way? Were you master of your car every second of the time? Were you driving according to the traffic regulations? Did you treat other street and highway users fairly? Did you show good sportsmanship?

Driving is not *sound* unless it is acceptable from at least four points of view: the technical, the social, the legal, and the personal. It must satisfy the requirements of all four of these points of view at the same time. You could drive without violating any traffic law and at the same time do things that are socially or technically unsound.

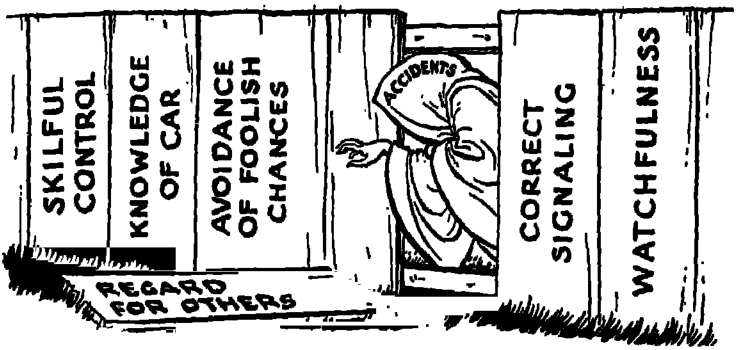


FIG. 184. You can keep accidents out by observing sound driving practices.

Joe Smith, for example, is driving with his family along a two-lane highway on a Sunday afternoon, enjoying the scenery at 15 miles per hour. The normal speed of traffic on this highway is 35 miles per hour. Joe is not violating the speed limit; he is driving in a technically sound manner, and with personal satisfaction. But behind him is a long, "honking" line of cars, unable to proceed at the normal rate, without taking chances, because of heavy oncoming traffic. Smith's driving is *socially* unsound.

Or a driver may punish his car with a clumsy technique. You've seen the kind—starting by a series of jerks, lurching around curves, dragging the clutch, grinding the gears on a shift to second, or stopping with a jolt that nearly throws passengers out of their seats. The driver may be physically sound, his practices strictly legal, and his consideration for other highway users all that could be desired. Yet his driving may be *technically* unsound.

Sound solo driving means that you are driving:

With complete control
In accordance with conditions
With smoothness of operation
With awareness of your social responsibilities
With fairness, courtesy, and good sportsmanship

COMPLETE CONTROL

The goal of all responsible solo drivers is *complete control* of the car during every moment on the road. The solo driver

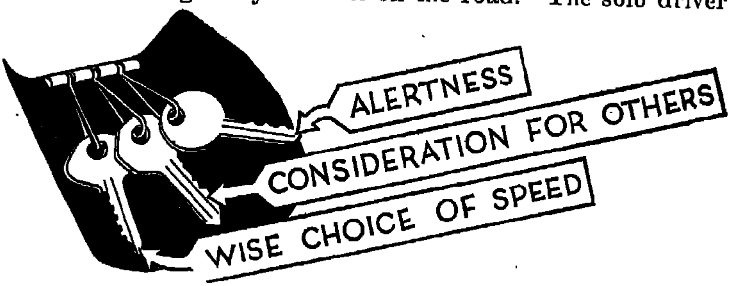


FIG. 185. Three major keys to sound driving.

is a *pilot* with full responsibility. The trained solo driver knows the right things to do to maintain constant control, and gives full attention to the task of driving.

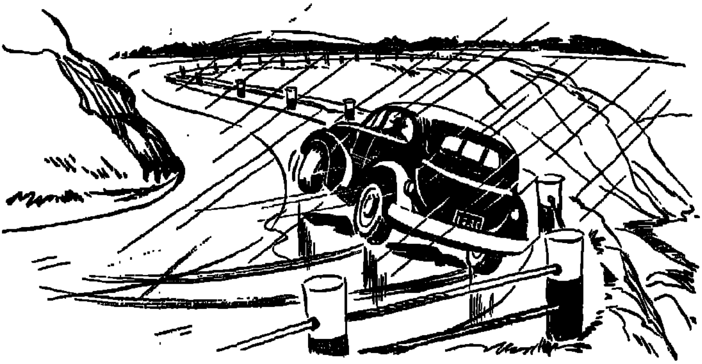


FIG. 186. Loss of control is a frightful experience. Learn from the driver who has been through it.

Control means no half-way matter. If you have control, you are master of the situation. Your car obeys your will. You know at all times that you can stop it within the safe stopping distance you have available. You are not going to be fooled into an emergency. No traffic accident will be due to your ignorance, lack of skill, disregard for regulations, foul play, or self-centered carelessness. You will keep yourself and other street and highway users strictly out of trouble.

Driving in Accordance with Conditions

Keeping out of trouble is essentially a matter of driving always according to conditions. Your speed will suit conditions; you will be in your proper lane; you will signal your intentions.

The principal things that will affect your driving and that must always be taken into account are:

The road surface
The weather conditions
The degree of illumination
The condition of your car

Your car load
Your own condition

The person who drives according to these conditions is the driver who has complete control.

When Conditions Are Adverse

The effects of adverse driving conditions are cumulative. Every time an adverse driving condition is added, your danger zone lengthens and your speed must be reduced.

FIG. 187. Factors which lengthen stopping distance.

You can graphically illustrate the cumulative effect of various adverse factors by showing how much the addition of each separate factor increases the stopping distance of your car. Assume that your reaction time is 0.75 second and that your car is traveling 30 m.p.h. under the best conditions. Calculate the stopping distance under normal conditions. Then add one adverse factor at a time. However great the resulting

FIG. 188. How many adverse conditions are operating here at the same time?

stopping distances, as shown in Table X, they are not uncommon in driving.

A combination of adverse factors can easily triple the length of your danger zone. Every adverse condition should be taken into account by an appropriate reduction in speed.

STOPPING DISTANCES AT 30 M. P. H. Under Increasingly Adverse Conditions	
CONDITIONS	STOPPING DISTANCE (Ft.)
No adverse conditions: road dry and level, weather clear, daylight, car and tires new, braking force 0.50 W,* driver alert, and reaction time 0.75 second................	95
Conditions as above, except that car is going down 5 per cent grade..................	101
Conditions as just above, except that wet pavement may reduce braking force to 0.25 W................................	183
Conditions as just above, except that smooth tires may reduce braking force to 0.20 W.	233
Conditions as just above, except that driver becomes fatigued and reaction time is increased to 1.5 seconds.................	266
* W = Weight of car. (0.50 W is about average braking efficiency)	

TABLE X

The practical question now is, "How much must speed be reduced under various conditions to keep a danger zone of constant length?" Assume that your reaction time is 0.75

second and that you are driving at 50 m.p.h. You then have a stopping distance, or danger zone, of 227 feet under favorable conditions. What speeds are necessary to maintain this 227-foot danger zone as you encounter various unfavorable conditions?

Table XI shows just what your speed must be for each set of conditions.

It has been necessary for you to cut your speed approximately in half to keep your danger zone from lengthening.

DRIVING CONDITIONS	PERMISSIBLE SPEED For Danger Zone of 227 Ft.
Hard, smooth, dry, level, straight road, clear daylight, driver alert, car and tires in good condition. (Assume a stopping force of 0.50 W* and reaction time of 0.75 second)	50 m.p.h.
Conditions as above, except that car is going down a 5 per cent grade	48 m.p.h.
Conditions as just above, except that rain reduces stopping force to 0.25 W	34 m.p.h.
Conditions as just above, except that smooth tires reduce the stopping force to 0.20 W	29 m.p.h.
Conditions as just above, except that driver becomes fatigued, lengthening reaction time to 1.5 seconds	27 m.p.h.
*W = Weight of car.	

TABLE XI

Carry the table further and build up Table XII by adding low visibility. This adverse condition now makes it necessary to shorten your danger zone further, so that your speed is reduced from 50 m.p.h., under ideal conditions, to 16 m.p.h., under adverse conditions.

DRIVING CONDITIONS	PERMISSIBLE SPEED UNDER ADVERSE CONDITIONS
Visibility good for 227 feet, 5 per cent down grade, wet pavement, braking force 0.20 W,* driver fatigued..........	27 m.p.h.
Conditions as above, except that poor headlights reduce visibility so that danger zone must be reduced to 175 feet....	23 m.p.h.
Conditions same as just above, but approaching glaring headlights make it impossible to see objects clearly farther away than 100 ft.....................	16 m.p.h.
* W = Weight of car.	

TABLE XII

Even with this reduction of speed to less than a third of your permissible speed under ideal conditions, your danger of colliding with an object ahead has remained practically unchanged! Failure to reduce your speed under such conditions greatly increases the chance of your having an accident. *Many accidents are caused by drivers who fail to take into consideration such combinations of adverse conditions.*

DRIVING IN A DESERT

"That must be a misprint," you probably thought when you

FIG. 189. Factors which reduce sight distance.

read the topic heading above. "How many people spend their time driving in a desert?"

"Not many," is the answer. "That's just the point."

But some drivers behave as though they thought they were driving in a desert, with no one to bump into and without the slightest obligation to anyone.

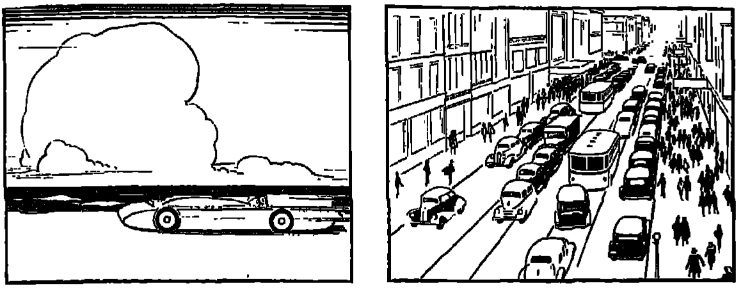


FIG. 190. As different as day is from night.

Driving is a social undertaking. What you do when you are soloing behind the wheel is of concern to many people. What Sir Malcolm Campbell did when riding alone in his own car on the wide-open, unoccupied spaces of the salt flats of Utah was, conceivably, a non-social affair and strictly his own business. Speed "at any cost" really meant *at any cost to himself*. But that is a rare situation. Such speed-record driving has few points in common with your solo driving in everyday traffic.

Your social responsibilities and obligations pile up heavily when you undertake to drive on public highways and city streets. You are personally responsible for your own passengers, for the occupants of other vehicles, for playing children and other pedestrians, for bicycle riders and animals, and for properties bordering on the highway.

Unless you have a responsible sense of *sharing the highway with other users* and an attitude that will make you determine to drive at all times with the safety of everybody uppermost in your mind, you have no right to be solo driving at all.

Do Drivers Accept Their Responsibilities?

The increasing number of serious accidents makes us question whether drivers are properly realizing and accepting their responsibilities.

A survey made in Massachusetts gives some interesting evidence that drivers *are not* accepting their responsibilities.

The survey indicated that 7% of the turns made by the cars observed were made from the wrong traffic lanes. With traffic as heavy as it is, this percentage of drivers failing to use the correct lane causes a great many crashes. In winter, 99% of the turns observed were made without hand signals! Even in the warm days of spring, over three-fourths of the turns were made without signals. If there is any virtue at all in the regulations requiring signals, such widespread disregard of rules indicates a dangerous situation.

Do drivers stop at STOP signs? Many drivers were observed disregarding STOP signs at intersections. Only a third of all the cars either stopped dead or slowed down to less than 3 miles per hour at STOP signs. Many failed to slow down even to 15 miles per hour. Locations were found where as many as two-thirds of the vehicles paid no attention to the STOP signs.

At traffic signals, drivers were again found to fail in responsibility. Some passed through red lights; some started before the change to green; 5% over-ran the stop lines. Drivers raced for the right-of-way and took it—in many cases, against the right-of-way rules. Large numbers of drivers failed to reduce speed at dangerous locations. Other driver faults observed in surveys were:

Passing on the wrong side
Cutting in
Passing on hill-tops and blind curves
Passing at railroad crossings and at intersections
Increasing speed when another car had signaled its intention to pass
Failing to give way to the car passing
Driving in the wrong lane

Straddling the center line
Failing to depress headlights when approaching traffic

The conclusion we must draw from such traffic surveys is obvious—TOO MANY DRIVERS ARE NOT ACCEPTING THEIR RESPONSIBILITIES. No one should be permitted to solo drive until he is ready to accept them.

There are three possible outcomes to such a condition:

1. Accident records will grow steadily worse.
2. Enforcement of traffic law will be rigid, and licensing procedure will be so strict that the licenses of large numbers of drivers will be permanently revoked.
3. We shall insist on producing better-trained drivers who will assume their responsibilities.

It will not take you long to choose the most desirable of these outcomes.

Responsibility Is Personal

"He was struck by an automobile." You would almost think that a ferocious car, angry, frightened, or thirsty for human blood, rose up like some gigantic animal and dealt a mighty blow.

"The automobile upset." "The car dashed heedlessly through heavy traffic." "She was run over by an automobile." Such news statements make the automobile sound like a wild thing that needs taming!

The automobile does not need taming. It has never yet done a wild thing of its own accord. The automobile alone does not kill, inflict injuries, or cause accidents. Our childlike statements placing the blame upon the machine cannot long obscure the fact that IT IS THE MAN BEHIND THE WHEEL WHO IS PERSONALLY RESPONSIBLE FOR EVERYTHING THE CAR DOES.

You are closely identified with your machine. You decide what the machine shall do, and then direct what it does. As fine an engineering product as the automobile is, it is no more conscious, accountable, or responsible than a puppet pulled by a string. It is never a sedan or a roadster that kills,

injures, or causes property damage; it is always John Jones, Mary Smith, or you, the solo driver, disregarding his driver responsibilities—failing to signal, driving too fast for conditions, cutting in, using the wrong side of the road, or committing some error of driving judgment.

You are fit to do solo driving only when you are prepared and willing to keep your car in constant control and accept your social responsibilities on the road.

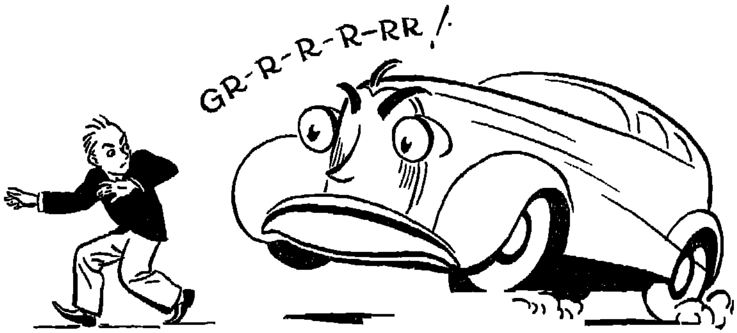


FIG. 191. "He was struck by a car!" As though the car itself were responsible.

Driving Is a Privilege

Sharing any public property is a privilege. Proof that sharing the highway as a driver is a privilege is found in the fact that you can be debarred from sharing it. Your license to drive can be revoked.

Any license implies a privilege. It also implies that the holder is permitted to undertake some activity that might become a public menace if not subjected to official control. This is true of the driver's license. Licensing automobile drivers is not merely a whim of officials. It is not primarily a source of public income. Its chief purpose is to set up and control certain *driving standards* known by experience to be for the public good.

Wherever the public is involved and could suffer harm or loss from the indiscriminate practice of some activity, a license is used to grant a privilege and to assure the public that the

holder is to be trusted. The business of the licensed peddler has been examined; the training of the licensed doctor has met certain standards; the licensed plane pilot is known to have satisfied certain requirements of training and fitness; the *licensed automobile driver* supposedly has a background which makes him a dependable user of the public highway. *A license is a badge of integrity.*

When it is clear that a license exists for the purpose of granting a privilege and that it promises that the holder is a person of training, experience, competence, and trust, then it is equally clear that incompetence, carelessness, and recklessness should be sufficient grounds for cancelling your soloing license and recalling the privilege.

Use of privilege is always a test of a person's judgment and common sense. The fit know how to use privilege; the unfit merely misuse it. Its use is also a very good measuring stick of maturity. The proper use of privilege is one very reliable indication that childishness has been put aside and that grown-up responsibility has been achieved.

SMOOTHNESS IN DRIVING

The passengers of a good driver are comfortable. They are not thrown sidewise on curves, banged against the windshield in stopping, given sudden jerks, and startled at missing other cars by risky margins. In fact, if you handle your car smoothly and efficiently, your passengers are not conscious of your driving.

Automotive engineering has done wonders in adding to riding comfort. But superior smoothness in riding is still dependent on your skill as a driver.

There are certain refinements in the technique of driving that show competence. They are the marks of the finished driver.

Avoid Sudden Swerves

The expert driver keeps in his own lane and drives in as straight a line as possible. He does not weave back and forth between lanes or across the center line. He does not make a sudden turn into a side street.

If you make up your mind rather late to turn, drive past the street and turn at the next street. Or, if necessary, drive by and turn around, rather than risk a sudden swerve. *Never* swerve your car if you can help it. Fatal accidents can be caused, for example, by drivers swerving suddenly to avoid hitting small animals that dart across the road. The faster the speed of the car, the more dangerous the swerve.

Slipping the Clutch

Slipping the clutch a bit when changing gears produces smoothness in driving. If you engage your clutch suddenly without slipping, you cause your car to be jerked up to the speed of the engine so rapidly that it lurches forward.

Smooth starting—a joy to passengers—comes with perfection in letting the clutch slip just enough to start the car slowly and evenly while the engine is running speedily enough to pull the load you harness to it. Practice letting in the clutch so slowly that you can barely feel the car begin to move. You will learn to sense just how much additional gas is needed to give more and more speed to the car as you gradually release the clutch pedal. This is expertly smooth starting, and at the same time it adds tremendously to your control of your car. When you have learned the art of properly slipping the clutch, you can move your car a hair's breadth, even on an upgrade, if traffic conditions ever make that necessary.

However, the clutch is a friction mechanism and can wear out. So it is a poor idea to "ride" the clutch pedal with the left foot when the clutch is supposed to be fully engaged. You can always be ready to depress the clutch *quickly*, if the need arises, without keeping your foot on it. When rolling along, *keep your foot off the clutch pedal.*

Even Acceleration

Smooth changes in speed give passengers a sense of confidence in the driver's competence. Some drivers, for no apparent reason, constantly step on and off the accelerator. The unexpected and unnecessary fits and starts of the car make a passenger feel that he must help do the driving by constantly

watching the road. There is a steady speed or gradual change in speed when a finished driver "drives ahead" and fits his speed to traffic conditions. His passengers relax and forget that they are riding.

A good test of ability to drive smoothly is to place a quart milk bottle on a level part of the floor of your car, and see whether you can start, accelerate, round curves, and apply brakes without upsetting the bottle. Then turn the bottle top end down and try for a greater degree of skill.

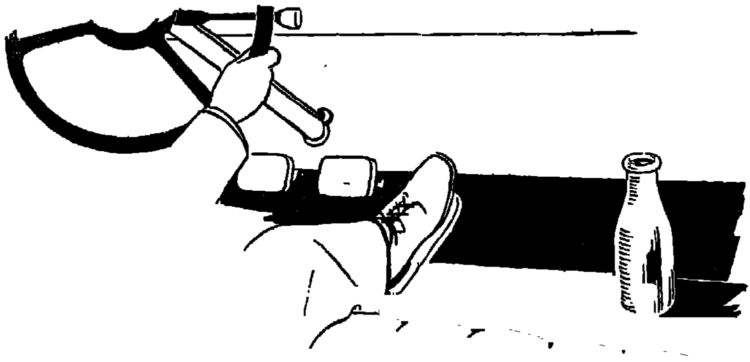


Fig. 192. Can you drive an hour without upsetting the bottle?

Smooth, even acceleration results in more than passenger ease and comfort. It is economical of gas and tires. And it helps prevent damage to the clutch, transmission, universals, and the differential gears.

Speeding up your car in the face of approaching curves, stop signs, and traffic jams, or at other places where you may very soon have to kill the momentum with your brakes, is uneconomical. Increased speed on a level road is the result of feeding additional gasoline. Momentum is bought with cash. You pay for it when you buy gasoline. Why, then, feed gasoline to produce momentum, only to destroy it almost immediately by means of the brakes?

In your solo driving, don't be a pedal-hopper!

Braking Properly

Some drivers overwork their brakes! They slam on the brakes for sudden stops; they use brakes when rounding curves; they screech their way along. Such drivers seem to think that brakes are the chief means of keeping the car in control. They are not. A good driver *rarely* needs to slam on the brakes. He anticipates conditions so far ahead that he is ready to meet them before they are upon him.

Decelerate your car by removing your foot gradually from the accelerator pedal and letting the engine do the larger part of your braking. Then your braking is gradual and easy.

The clumsy driver who jams on his brakes gives his passengers some bad moments. When the momentum of the car is suddenly checked, inertia tends to carry the passengers forward at the same rate the car was traveling. That sensation of pitching helplessly forward is a very unpleasant one! It is dangerous too. Persons have been seriously injured by being thrown against the windshield, the coat rail, or some other part of the car when brakes were suddenly applied. Put your brakes on so gradually that your passengers scarcely know the car has been brought to a stop. If you ever slam your brake on, it should mean a real emergency, and with a first-class driver an emergency situation rarely, if ever, comes.

Too hard pressure on the brakes is likely to cause skidding. On slippery roads, the speed of the car should be so controlled that the brakes are not needed, for even the most expert application of them is likely to throw the car into a skid. *Avoid the necessity of braking on slippery roads.*

Some of the new synthetic tires make stopping more difficult than with tires of natural rubber. Their tractive resistance is poor on snow and ice, and possibly even on dry pavements in cold weather. The fact that synthetic tires must be kept highly inflated to prevent sidewall wear helps decrease their braking resistance. Be especially cautious in braking with synthetic tires.

On long hills you may sometimes catch unpleasant whiffs of burning brake linings. Continued braking while going down-

hill has overheated them. The results are shorter brake life, loss of braking efficiency, and perhaps warped brake drums. Rather than shorten the life of your brakes, change to a lower gear and let the engine help do the braking on the hill.

GOOD SPORTSMANSHIP AT THE WHEEL

Good sportsmanship is a combination of fair play and courtesy. Fair play means you must know the rules. Courtesy means you want to observe them.

Fair Play

In every game, certain acts are recognized as fair play and other acts as fouls. Spectators watch fair play with admiration, but they protest and boo at fouls.

Try excusing the player who habitually fouls by saying that perhaps he doesn't know the rule. "What business has he in the game if he doesn't know the rules?" the spectators growl.

Every game has its standards of fair practice. Business, too, has its own recognized practices of fair play. Automobile driving is no exception. You can draw a distinct line between fair and foul play in driving.

"What business have you on the highway if you don't know the laws?" the traffic officer correctly protests when a violator tries a plea of ignorance.

The fact is, you are not ready for solo driving until you know the rules and consistently observe them.

Courtesy

Sticking to the rules is fair play. But good sportsmanship is more than that.

There is no rule in football that requires a player to help a fallen opponent to his feet after a tackle. No regulation in tennis, golf, or hockey requires you to congratulate your successful opponent, or to recover another's out-of-bounds ball. These practices go beyond fair play; they are acts of courtesy.

Acts of driving courtesy that go beyond fair play mean good sportsmanship at the wheel. The strictly fair-play driver

never consciously breaks a traffic rule. He never cheats at stop signs or red lights. He takes the right-of-way only when it is legally his. But the sportsmanlike driver goes further. He obeys the regulations and extends additional acts of courtesy that give other drivers and pedestrians every chance for safety. He is numbered among the millions of good drivers who make driving a pleasure.

A certain young man who is recognized among his friends as an exceptionally competent driver expresses the courtesy back of his driving philosophy very simply: "I'm never in such a hurry that I can't give the other fellow a chance."

Rude highway manners are disagreeable. They are also dangerous.

One man who has surveyed the automobile accident situation

VIOLATION OF SPORTSMANLIKE DRIVING RULES	VIOLATIONS PER 100 DRIVERS INVOLVED IN TRAFFIC ACCIDENTS
Exceeding speed limit	3
Exceeding safe speed	3
Demanding right-of-way	11
Following too closely	5
Passing improperly	4
Driving on wrong side of roadway	7
Failing to signal or giving improper signal	3
Turning improperly	4
Disregarding signal or officer	1
Disregarding stop sign	2
Disregarding warning sign	1
Parking-starting improperly	4
Other improper driving practices	10
No violation reported	47
Under influence of alcohol	5
1945 data, from 1946 Accident Facts	

TABLE XIII

systematically says that *consistent practice of road courtesy by everyone would reduce traffic accidents in the United States by at least one-half.*

Table XIII shows the violations of sportsmanlike driving practices that most commonly result in traffic accidents.

Discourtesies were the cause of a large proportion of the automobile accidents in which 33,500 persons were killed and 1,150,000 injured in 1946. This is the terrific price we pay because of the bad manners of unsportsmanlike drivers.

FIG. 198. No one would stand for it, afoot. The public must not stand for it in driving.

Many commercial organizations insist on such high standards of sportsmanship in the drivers of their fleets that truck and bus drivers are gaining a reputation for exceptional courtesy. They are required to drive, not merely within the law, but to exercise every common-sense care and to do all in their power to make the highways safe and pleasant for other drivers. Some large truck and bus organizations emphasize road courtesy so much that they will not employ drivers who fail in courtesy. The time is rapidly coming when only sportsmanlike drivers will hold really worthwhile commercial driving positions.

Some drivers are more considerate and patient than others, because they realize that there are all kinds of drivers on the road. The various drivers you meet on the highway differ

in mental ability, physical fitness, experience, stage of learning, degree of skill, emotional balance, and attitude. Some of the drivers with whom you share the road actually need your help if they are to get through traffic without accidents, for not all of them are experienced, well-trained, or smart. When you exhibit discourtesy to them you become as poor a driver as any of them.

Tolerance of other drivers' difficulties shows a mature point of view. It comes with intelligence and social attitudes. A tolerant driver takes no unfair advantage of the mistakes of others, nor does he try to "get even" with show-off drivers. He knows his driver psychology too well for that.

A sparing and courteous use of the horn is one of the marks of the self-disciplined driver. The poor driver over-uses the accelerator, the brakes, and the horn. He steps from accelerator to brake pedal and back to accelerator. He drives with "fits and starts" and loud blasts from his horn. He is really warning everyone on the highway that a very poor driver is on his way.

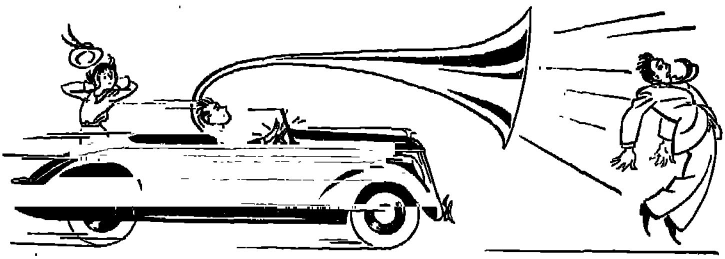


FIG. 194. Horning his way along.

A driver shows good sportsmanship when he uses his passing headlight beams, passes properly, signals his intentions clearly, and follows at a safe distance. He shows it by driving to the right, giving the other fellow a chance, and performing many other acts of both fair play and courtesy.

Knowledge, supervised road practice, skill, sound driving habits, smoothness, techniques for keeping out of trouble, and good driver sportsmanship will make you a first-rate solo driver.

DISCUSSION TOPICS

1. Suggest and discuss specific driving practices that could be classed as "fouls."
2. Illustrate and develop the idea that "driving is a social undertaking."
3. Give illustrations of cooperative and non-cooperative practices in the use of streets by pedestrians; in the use of an automobile.
4. Which would you consider more dangerous: (1) a practice which satisfied the social but not the legal aspect of soundness, or (2) one which satisfied the legal but not the social?
5. What sort of driver would you call "smooth"? How does he achieve driving smoothness?
6. Discuss the meaning of the word "tolerant." What characteristics in some drivers require the tolerance of other drivers?
7. What is the relation between frequent horn-blowing and poor driver attitude?
8. Give examples of road courtesies you have seen extended by truck and bus drivers. Debate: the road courtesy of the majority of truck and bus drivers is superior to that of the average passenger car driver.
9. Discuss the effect of car load on:
   Weight distribution
   Headlight adjustment
   Center of gravity
   Visibility
   Manipulation of controls
   Braking
10. Discuss: "A person has a right to load his car as he chooses. What and how much he carries is his own business."

PROJECTS

1. Observe drivers. Can you pick out the incompetent ones who have not passed the learner stage and who, therefore, should not be doing solo driving? What "gives them away"?
2. Make up a rating scale to be used by passengers in rating drivers with whom they ride. Try it out with several drivers.
3. Observe the smooth, almost imperceptible starting of a first class locomotive engineer. Practice slipping the clutch until you can start an automobile with equal smoothness and control.
4. To form an idea of how frequently a driver in your community must adjust himself to the faults of others, spend half an hour at a street intersection and note the percentage (a) of drivers who "beat" the lights, (b) of drivers who turn left without signaling, (c) of pedestrians who cross against the lights.

5. List as many separate reasons as you can why you should slow down while driving at night through a hard snow-storm. On some level, straight stretch of the road where 40 m.p.h. might be a proper, good-weather, daylight speed, how much do you think you should drop your speed in a hard snow-storm?
6. Check those items in Table XIII that are definitely violations of sportsmanlike courtesy and not alone violations of driving regulations. Work out the percentage of the accidents you checked.
7. Cover two flat blocks of wood with coarse sandpaper. Press the sandpaper surfaces tightly together. Note that it is very difficult to twist one on the other. When the clutch is fully engaged, its friction surfaces grip each other tightly in the same way. Next, press the two sandpaper surfaces together only lightly. Note how much easier it is to rotate one on the other and how rapidly the friction surfaces are worn off. When you "ride the clutch" the results are similar.

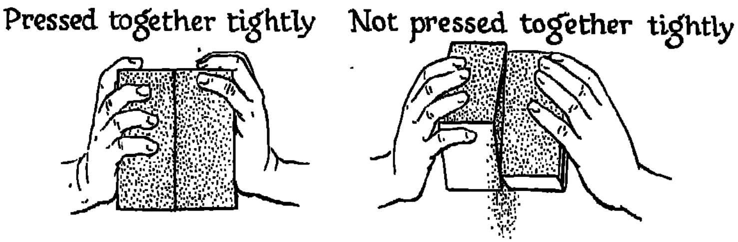


FIG. 195. Avoid "riding the clutch." A fully engaged clutch grips well; a slipping clutch wastes power and wears rapidly.

FOR FURTHER READING

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CHAPTER XVII

Driving on the Open Highway

Do You Know:

How to interpret traffic signs and signals?
How to follow, pass, and meet other vehicles?
How to drive smoothly around curves?
What is good practice at hillcrests?
How to get out of a skid?

THE STRAIGHT ROAD

DRIVING on a straight road would seem to be the simplest kind of driving—and in many respects it is. But investigations show that *most rural accidents occur on straight roads.* Evidently, as simple as straight road driving seems to be, it presents plenty of difficulties and dangers.

Good drivers on the open road size up traffic conditions as far ahead as they can see. They are not taken by surprise. They plan for a clear path and continued control of the situation.

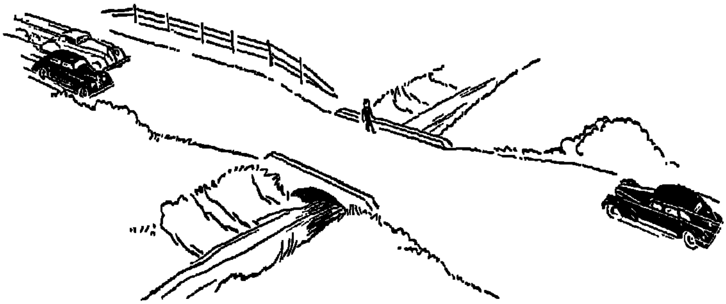

FIG. 196. The expert driver anticipates situations ahead. What is likely to happen when the passing speeder reaches the bridge? If you were driving the car that he is passing, what would you do?

Some drivers are always getting into trouble because they fail to anticipate hazards and trouble-in-the-making. They are like people who must meet the "rainy day" with no savings. Knowledge of what can be expected ahead is a driver's "savings".

It is not enough to know what the situation ahead is at the time you see it. What will it be by the time your moving car catches up with it? Every little sign of what is developing must be observed.

Interpreting Traffic Signs and Signals

Traffic signs and signals are very important guides wherever you drive. Know how to interpret them at a glance. Know the meaning of each one, not only by the lettering, lines, or reflectorized pattern on its face, but by the characteristic shape used for its special purpose.

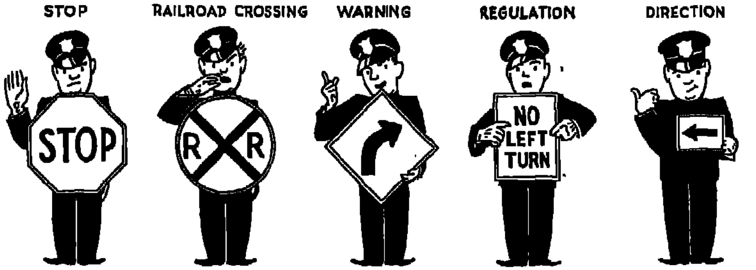

Fig. 197. Even the shape of a *standard* traffic sign has a definite meaning.

For quick identification, traffic signs are standardized in shape, color, wording or symbol, and the way they are installed. Signs that are most important at night should be reflectorized. You see buttons or other reflecting elements on such warnings as STOP at through highways and streets and RR for railroad crossings. Some signs are illuminated for better night visibility.

Properly placed traffic signs warn of dangers you might not otherwise see. They indicate where reduced speed is necessary, advise of traffic regulations, give route information, show the kind of curve you are approaching, and help in many other ways. Whether on open road or in city driving, a driver must be able to recognize quickly what these traffic guides mean.

Just as important is the quick interpretation of intersection signals. Be familiar with the standard meanings and the usual order of appearance, as shown in Fig. 198.

Where important streets or highways cross, or where there are special dangers, you sometimes find blinking red or yellow signals. Come to a full stop at a blinking red signal and proceed only when you know there is no danger. Greatly reduce your speed at an intersection guarded by a blinking yellow signal and go through with special caution.

Traffic signs and signals are installed for one purpose—to help you in your driving. You should be as familiar with them as you are with the control devices in your car.

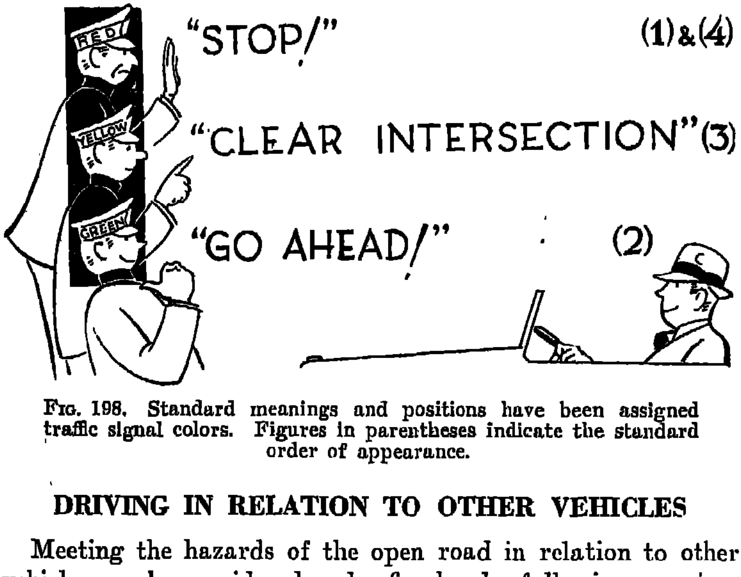

FIG. 198. Standard meanings and positions have been assigned traffic signal colors. Figures in parentheses indicate the standard order of appearance.

DRIVING IN RELATION TO OTHER VEHICLES

Meeting the hazards of the open road in relation to other vehicles can be considered under five heads: following, passing, meeting other cars, stopping along the highway and signaling your intentions.

Following

Too many drivers follow too closely. The distance at which it is safe to follow another car depends on speed, road, traffic, weather and light conditions, car condition, and your own alertness and reaction time. It is a greater distance than most drivers realize.

This *following distance* need not be so great as the *stopping distance,* for the car ahead can no more "stop on a dime" than you can. But the car ahead may stop quickly—sometimes more quickly than yours can. And because you must allow for your reaction time and your braking time, you should always follow at a reasonable distance. If, through poor judgment, you follow too closely, any mistake or sudden act of the driver ahead is almost sure to involve you in a costly emergency.

Here is a simple rule of thumb followed by many professional drivers: *A driver with an average reaction time should stay at least 20 feet, or slightly over one car length, behind the car he is following for each 10 miles per hour of his speed.*

Where traffic is heavy, there are few opportunities for traveling at a faster rate than that of the average car. The driver who weaves in and out of line trying to get ahead gains nothing to offset the confusion and hazard he causes.

On the other hand, you can be a nuisance, if not a menace, if you lag just far enough behind to tempt the driver behind you to try to overtake and pass you. Keeping pace with a general stream of well-spaced traffic generally averages up to the best rate of travel you can comfortably, safely, and considerately make.

Passing

To pass or not to pass! Here is where judgment comes in. The habit of *not taking a chance* will help. But each situation

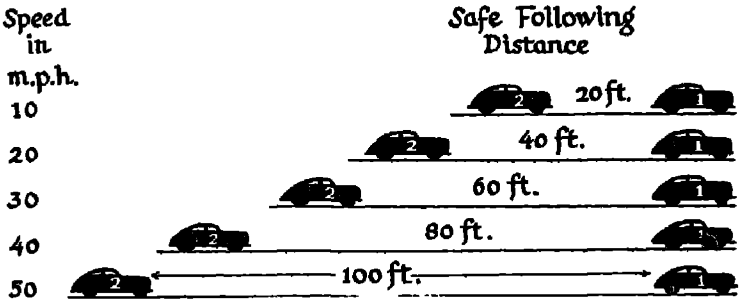

FIG. 199. Maintain these safe following distances for the given speeds.

is made up of different conditions. Judgment is needed in deciding whether passing is safe or whether it means taking a chance.

A slow vehicle crawls up the hill ahead of you. The driver beckons you to pass. If you pass "blind", you abandon your own judgment and trust to his. If the result is an accident, you are the one who suffers and who pays the damages!

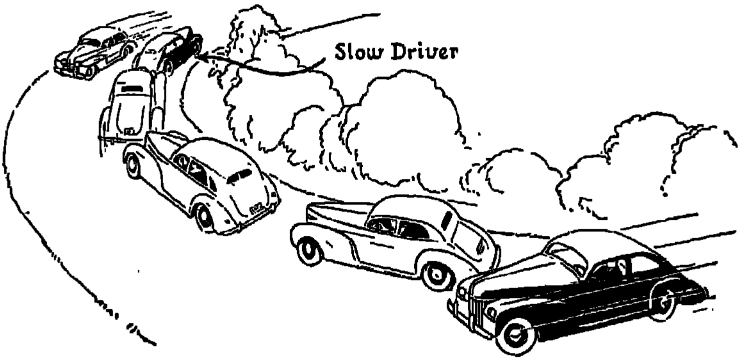

FIG. 200. The slow driver, by holding up a line of cars, causes irritation and impatience, often tempting others to take chances.

The most important rule about overtaking is: "*Overtake and pass only when you are sure you can easily make it safely.*"

It is very easy to underestimate the distance required to overtake, pass, and get back on your own side of the road. Plan a generous margin of safety. The driver who passes in tight situations, especially on curves and at hillcrests, simply has no idea of the distances required for passing. To pass a car comfortably and safely it takes a minimum of 10 seconds, regardless of the speed. If your passing speed averages 50 m.p.h., you travel 733.3 feet from the time you pull out of your lane to pass until you can safely cut back into your own lane. If the car you are passing is going 40 m.p.h., it will have traveled 587 feet, or the equivalent of 33 parked cars.

If a car is approaching from the opposite direction at 50 m.p.h. when you start to pass, the space used up between you and that car, during the 10 seconds required for passing, will be 1466.6 feet. Add 293.4 feet (two seconds clearance) as a

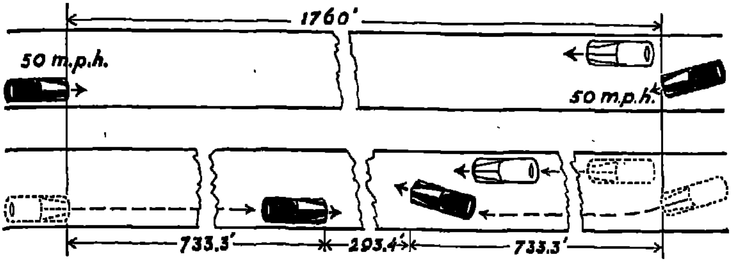

FIG. 201. More "clear distance ahead" is required for passing than is generally realized.

margin of safety, and you find that you need a clear, unobstructed distance ahead of 1760 feet to assure safe passing. Learn to estimate this safe passing distance accurately and you have added another touch of skill to your driving.

In overtaking another car, know what is behind you. If a car has slipped up behind you and has already started to pass, you will be side-swiped if you suddenly swing out. A single hurried glance in the rear-view mirror will not tell you positively that no one is attempting to pass you, for the "blind area," created by the back corners in closed cars makes this uncertain.

So look in the mirror in ample time before you start to swing the car to the left. Hand signal as for a left turn. Always sound your horn to attract the attention of the driver of the car ahead so he will not decide, at the same time, to pass the car ahead of him and swing into your path.

Warning of intention to pass is very important. In Fig. 202, A decided to overtake B, but gave no signal. Just as A drew

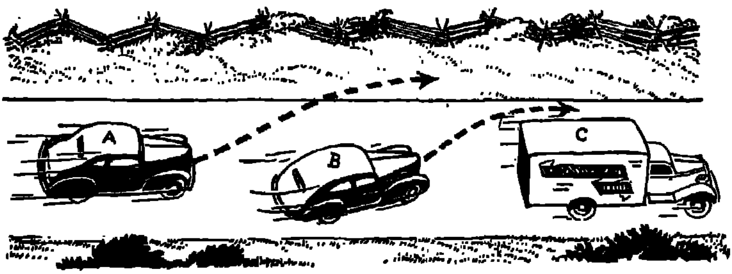

FIG. 202. Signals are important in overtaking and passing.

out, B decided to pass C. A, in passing, had to guide his course by B, and suddenly found his car in the ditch. Had A given warning, B could have waited before passing the truck, or could have signaled back to A to wait while he first overtook it.

After you have passed a car, it is safe to return to your proper lane only when, in your rear-view mirror, you can see the car you have passed.

When anyone signals his desire to pass you, courtesy, as well as the *law* in most states, requires that you do nothing to interfere, either by obstructing the roadway or by increasing your speed.

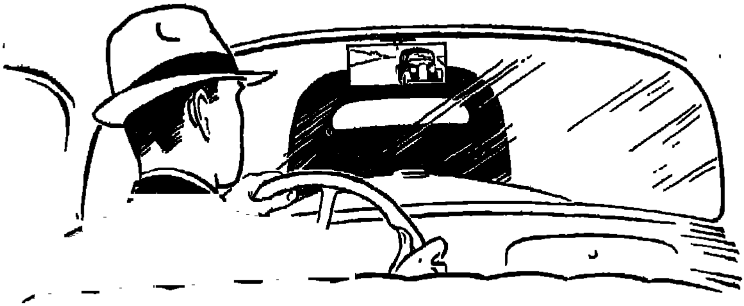

FIG. 208. Eyes to the rear.

Your responsibility goes further. You must help make it possible for the other car to pass you safely. Keep to the right, and *reduce* speed slightly. If you interfere with a passing car and something unexpectedly develops, you too are likely to be forced into a ditch, side-swiped, or involved in some other kind of accident. Only childish and "dog in the manger" drivers deliberately interfere with another driver's right to overtake. A sportsmanlike driver gives him the road.

Here is a sound practice to follow in overtaking a car. When you wish to overtake, but an occasional oncoming car holds you back, drop back a bit. Just as an approaching car is passing, and when you have sufficient clear distance ahead, build up your speed for a "running start" while still in your own lane. In this way you reduce to a minimum the passing time and distance.

Meeting Other Cars

Although half the roadway is yours, an approaching driver may not be fair about it. For all you can tell, he may be the worst driver in the state. He may be inattentive, incompetent, drowsy, or even drunk. If you don't like the way he is approaching, pull over to the right-hand side of the road as far as the pavement permits and warn him with your horn.

When things happen between approaching cars, they happen in a hurry.

Two cars approach each other at a speed equal to the sum of their speeds. This means that the mental reactions which meet the situations when cars are approaching each other must be exceptionally quick.

A man is driving at 40 miles an hour. If a car approaching him on the middle lane of a busy three-lane highway is also traveling at 40 miles per hour, the space between them is being used up at the rate of 80 miles per hour. If each driver has the average reaction time of 0.75 second, and each car has brakes just meeting the Uniform Vehicle Code requirement, the drivers would have to see each other approaching and *start trying to stop* when at least 328 feet apart, if they were to bring their cars to a stand-still before crashing. Should an emergency arise within the 328-foot space which would necessitate a full stop to avoid a head-on crash, *it could not be met* successfully. It's not surprising that many accident victims report, "It was all so quick. I don't know just what did happen."

Stopping Along the Highway

The principal thing about stopping on the open highway is *never* to stop in such a position that vehicles approaching from behind will come upon your car unexpectedly, or be forced into danger by having to move around you on the wrong side of the road. Always pull *off the pavement* to the right when you stop. Even in the case of a breakdown or a flat tire, pull entirely off the roadway. If the shoulder isn't wide enough, keep going until you can stop where sight distances are good in both front and back. It is better to ruin a tire than to have another car crash into you.

At night, it is especially important to stop *entirely off the pavement*. A driver who sees a tail-light ahead may not realize soon enough that it is on a car that has stopped, particularly if he is facing the light of an oncoming car.

Signaling Your Intentions

Persons who have to adjust their actions to those of others have the right to know what others are going to do.

Puzzles and conundrums have their place. But the little highway game of "What Do You Think I'm Going to Do Next?" is as dangerous as dynamite!

Should a driver expect other persons on the highway to be mind readers? It may be perfectly clear to Bob in the truck that he's about to stop suddenly, swing to the left and pass the car ahead, or dart into a side road on the left side of the highway. But to the driver behind him there is nothing clear about it until the act is in progress—unless Bob signals his intentions.

FIG. 204. We can't expect other persons on the highway to be crystal gazers.

There are four common ways of signaling: (1) with the horn, (2) by use of the left arm and hand, (3) by use of signal lights, or mechanical arm devices, and (4) by the proper position of the car on the roadway.

The horn is merely a general signal to sound warning or attract attention to the car. It is a useful means of signaling,

but it is often over-used. A driver has no right, simply because he can attract their attention, to "honk" others out of the way. The sportsmanlike driver is very sparing in the use of his horn.

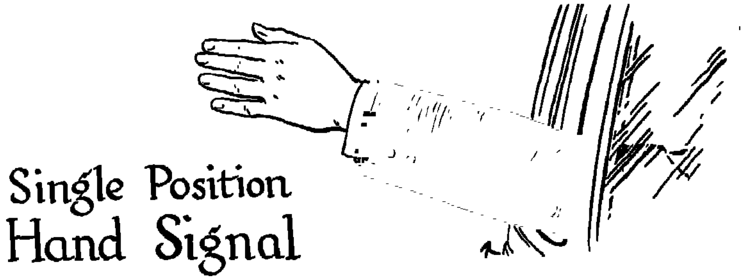

Fig. 205.

Unfortunately there is no one set of hand signals in universal use. In some states, the arm is merely extended outside the window horizontally for all changes in either speed or direction. This practice, like sounding the horn, is merely a general warning for others to watch the car.

But certain signals are so generally prescribed by state laws that every driver should know them. The following "three position" set of signals is recommended by the Uniform Vehicle Code followed by many states:

1. LEFT TURN—arm extended horizontally.
2. RIGHT TURN—arm extended upward.
3. STOP OR SLOW DOWN—arm extended downward.

A modification of this system provides for indicating right turns by extending the arm horizontally and moving the hand about the wrist with a circular, beckoning motion, telling cars to come ahead.

You *may* meet drivers from other states, with different systems of signaling. So a sound rule to follow is this: *when an arm appears out of the window of a car ahead, be on the alert and prepare to slow down.* Of course the driver *may* be knocking ashes off a cigarette, or waving to a friend, or pointing out

something—but he may also be signaling that he is about to change his course or speed.

The position of the car on the roadway, especially at intersections, should give additional cues to drivers as to possible directions of travel from the different lanes. The almost universal practice is to make right turns from the extreme right, and left turns from the lane next to the center of the road.

The *time* when the signal is given is very important. If signals are to be of value, they must be given *soon enough* and continued *long enough* for them to be observed and acted upon. A late or an abbreviated signal is only a little better than no signal at all.

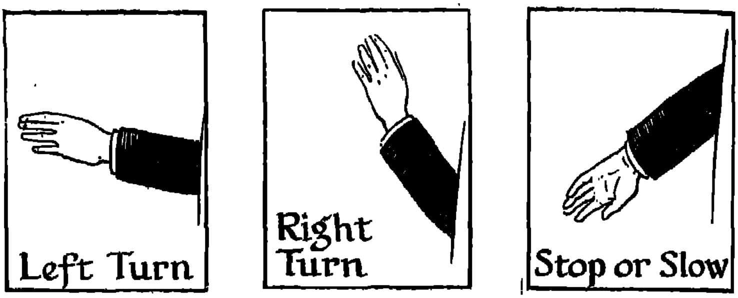

FIG. 206. A system of hand signals used in many states, and recommended by the Uniform Vehicle Code.

ROUNDING CURVES

Curves are among the special hazards of an open highway. The system of forces acting on a car is more complex on curves than on straight roads, as you have learned in Chapter IX. If you do not slow down properly before entering a curve, the car swerves. In such an unexpected swerve, there is real danger of leaving your lane, or even the highway.

Good drivers slow down *before*, not after entering a curve. *A car is steadier on a curve when the engine is pulling* than when it is coasting or being slowed down. Therefore, a driver should enter the curve slowly enough to enable him to accelerate slightly when actually rounding it. He should use the brake *before* he reaches the curve, if the curve is going to demand re-

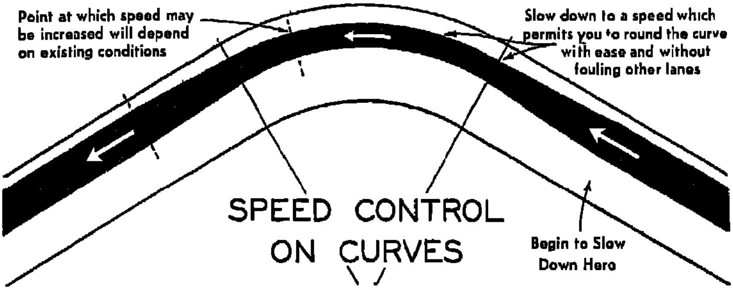

FIG. 207. How to "take" curves. The narrower the black band, the slower the speed.

duced speed. He should not have to brake when actually on it.

Having to brake on a curve is a dead give-away of incompetent driving. It means that the driver has put himself in a position where he must undertake a difficult and foolish struggle with certain forces of nature. The struggle may result in squealing tires, a rolling car, lurching passengers, a skid, awkward steering, or worse trouble. On the other hand, let him take the curve the right way, so that his passengers are not even "curve-conscious," and he will be doing a finished piece of driving.

"You can tell he's a good driver by the way he takes the curves." Have you heard that remark? With an incompetent driver, passengers slide back and forth, clutching for straps or seat edges and apologizing to other passengers for all but embracing them or slipping into their laps. It is the driver who should apologize. He isn't doing a good job.

Keep your passengers comfortable and safe by skilfully "easing" into and out of curves. To do this, on a left-hand curve, for example, start well out toward the right-hand edge of the pavement as you approach the curve. Then, *while still on the straight-away,* turn the steering wheel just a bit as you come closer to the curve. Gradually increase the amount of the turn of the wheel—always keeping on your side of the road. At the end of the curve, ease off again toward the outside of your lane. Your passengers will be more comfortable, and you will display skill at the wheel.

There is another good reason for special care on curves. Curves are places where the "sight-distance" is shortened; that is, the driver cannot see so far ahead. It is bad enough to drive on the wrong side of a straight road. It is obviously much worse to be on the wrong side of the road on a sharp curve.

Stay on your own side of the road on curves would seem unnecessary advice. But accidents are constantly occurring because drivers round curves on the wrong side of the road.

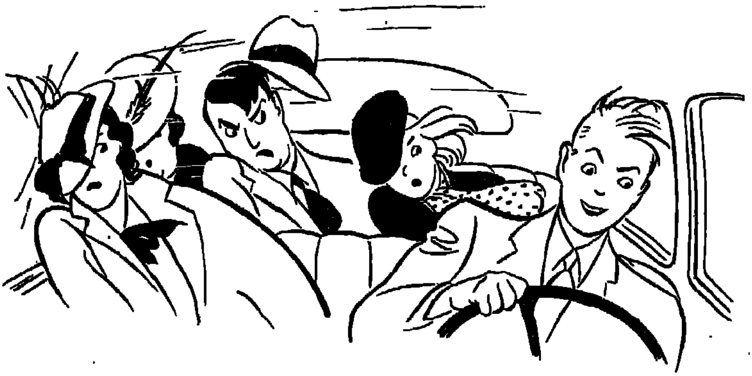

FIG. 208. An inexpert or unsportsmanlike driver taking a curve. How do you think the passengers rate this driver?

A driver belonging on the outside of a left-hand curve may try to "flatten" it by cutting across on the inside. He fails to consider the rights of other drivers. He is fouling a lane on which he has no right to drive.

If he stops on the curve and compels the drivers following him either to stop or to pass on the dangerous left side of the road, he is clearly doing what he has no right to do.

GOING OVER HILLS

Hillcrests offer another open highway hazard. Approaching the crest of a hill, you see only to its top. You have no way of knowing what traffic conditions exist beyond. There may have been a collision, with wreckage strewn across the entire roadway. A thoughtless driver may have stopped on the downgrade to examine his car or study a map. A car coming from

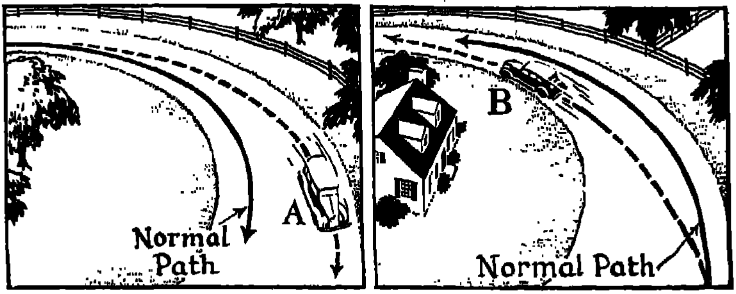

FIG. 209. "A" is going too fast. He *has* to lengthen his radius, in order to avoid skidding, while he slows down *on* the curve to a speed at which he can use the shorter radius. "B" has *deliberately* lengthened his radius to go around the curve without slowing down. In both cases other lanes are fouled. Speeds should be such that the "normal" paths can be followed around the curve.

the opposite direction may be foolishly passing another, using your side of the road. You must be prepared to meet unexpected situations.

Never overtake a car near the crest of a hill. Your traffic "sight-distance" ends at the hillcrest, and so you can NEVER safely cross the center line.

It is certainly irritating to follow a big, slow-moving truck up a long winding hill and have to shift into a lower gear. But if the only alternative is to pass without seeing far enough ahead, an experienced driver follows the truck at a safe distance and takes his delay philosophically.

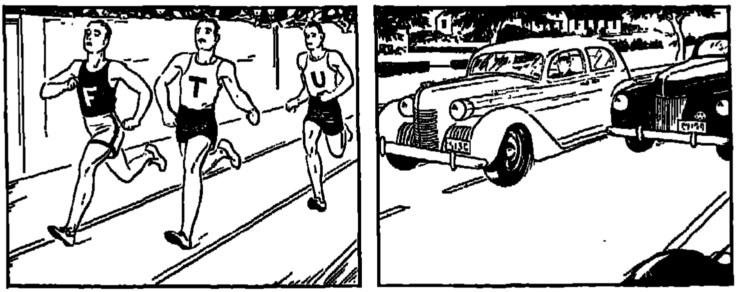

FIG. 210. A foul! Distasteful in sports, hazardous in driving.

A little headwork and you may be able to avoid such an irritation. By *thinking ahead* and sizing up the speed of the truck, you may be able to overtake it far enough ahead of the crest to *have proper sight-distance.* In that case, start well behind the truck, speed up, and pass. Or, so adjust your speed that you are some little distance behind the truck until it nears the crest. Then speed up moderately, and if the road beyond the crest is clear, pass the truck quickly at the beginning of the downgrade, before it has picked up speed. Strategy of this kind is always worthwhile and marks the competent driver.

You have the right to pass near hillcrests only on roads with

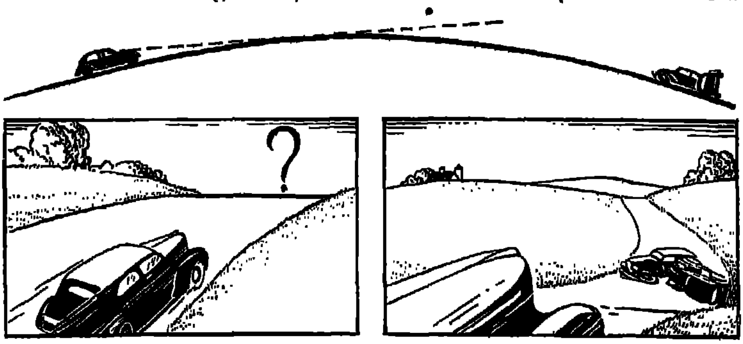

FIG. 211. Who can tell what is just beyond the hillcrest?

four lanes or more. But even on such roads, unless there is a divider strip, it is better to hold down speed and pass only when the sight-distance is adequate. For even here, a wreck over the crest may have caused a careless driver to come over onto your side of the road.

Reduce speed as you approach the top of a hill. As you go over the crest and start down, "sight-distance" increases but braking distance lengthens. So careful control over speed must be maintained. Drive at a speed that would let you stop within the clear distance you can see ahead. Otherwise you are at the mercy of circumstances, and surrender your control over accidents.

In going down a long, steep grade, it may be better to shift into a lower gear. Then, when you remove your foot from

the accelerator, *the car drives the engine.* This action slows down your car and saves wear on the brakes.

When brakes also must be used on a long downgrade, a skilful driver keeps a light pressure on the brake pedal. In this way, the car is kept from getting up an unreasonable speed, and less heat is built up in brakes and tires than when brake pressure is applied intermittently.

Never coast down hills with the gear-shift lever in neutral, or with the clutch disengaged. In many states, such practices are illegal. For, with the gears in neutral or the clutch disengaged, the job of slowing down and stopping is thrown entirely on the brakes and tires. If, on the other hand, your car is in gear, the motor helps your brakes when you take your foot off the accelerator pedal.

In addition to lengthening your stopping distance, "coasting" with your clutch disengaged can be very hard on your car, for there is likely to be a severe jolt and strain on mechanical parts, unless motor speed is brought into step with car speed when your clutch pedal is let up again.

In going up a long, steep grade, never hesitate to shift into lower gear if your car will have to struggle to make the hill in high. Don't wait too long before shifting. If your speed has dropped to about twenty miles an hour and the car is beginning to labor, shift gears, unless you are very near the top of the hill.

INTERSECTIONS

Rural intersections of highways present essentially the same problem as the intersections of city streets. Speeds are greater on rural highways, and you must begin to slow down much sooner. A general rule applies: *Approach intersections at such a speed that your car can be stopped short of any person or vehicle that is likely to cross.*

Grade Crossings

Grade crossings make a particularly dangerous kind of highway intersection. About 1600 persons are killed each year at points where highways and railroad tracks cross at the same level. In the daytime, the great majority of grade crossing

accidents, 88% in 1944, is caused by the locomotive striking the automobile. At night, in more than half of the accidents, 52% in 1944, the *automobile* strikes the train. In 18% of the 1944 crashes, the train was struck *behind the locomotive.*

Many accidents of this kind are apparently due to lack of adequate, night-effective, advance warning of the grade crossing. Others are due to inattention or to excessive speed. The driver may fail to find out whether or not a train is coming before he starts to cross. He may fail to see the warning sign soon enough. Or he may overdrive his lights by traveling so fast that he is unable to stop within the distance his lights illuminate.

At the usual grade crossing on the open road, *the train always has the right of way.* In the nature of things it must. Its steel wheels on steel rails can develop so little stopping friction that it requires many times the stopping distance of an automobile.

PAVEMENT EDGES

In open highway driving, the edge of the road pavement can be the cause of very serious accidents. When there is a ridge between the road pavement and the road shoulder, your car can easily be thrown into a skid. Drive so that the right wheels of your car are always on the paved surface of the roadway.

If your right wheels do leave the paved surface, be very cautious about getting them back on the pavement.

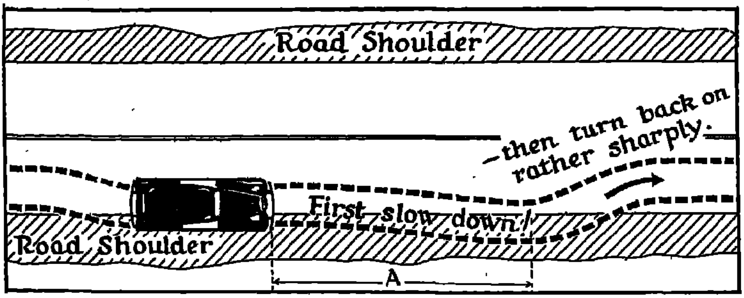

FIG. 212. Getting back on the pavement without trouble. The distance "A" should be much longer than is shown—sufficiently long to permit slowing down to *low* speed.

Never try to get back on the pavement at high speed. Avoid getting panicky and slamming on the brakes. Drive straight ahead, with the right wheels off the pavement, and slow your car down gradually. Drive at slow speed with the right wheels about two feet out on the shoulder. Look carefully to see that the roadway is clear behind you, then cut back on the pavement by turning the front wheels rather sharply to the left. A quick jerk back at high speed, or an attempt to get back on the pavement while you are driving nearly parallel to the edge, can be very hard on the tires. Worse still, it can throw the car into a sudden skid. See Fig. 212.

SKIDDING

Competent drivers generally stay out of skids. They know what circumstances are likely to cause skidding, so they avoid creating such circumstances.

Good drivers always take account of the crown of the road, the sharpness of curves, irregularities of road surface, the available friction, and the car speed.

Cars can be thrown into a skid by:

- Speeding up too suddenly or applying the brakes too hard —especially on slippery curves and grades, or on surfaces covered with wet leaves, sand, mud, oil, ice or snow.
- Driving too fast on curves.
- Swerving suddenly from a straight course.
- Driving too fast while on rough roads, or while crossing the crown of the road.
- Uneven braking on the four wheels.
- Improperly inflated tires.
- Worn tires, resulting in a low coefficient of friction and sometimes in blow-outs.

Notice how frequently excessive speed occurs in these causes of skidding.

Expert drivers who must use brakes in such circumstances never try to stop suddenly and never hold the brake pedal down long. They "snub" with the brakes. This means putting the brakes on and off *gently* in quick succession. This "snubbing" checks the speed a little at a time and prevents a skid.

If slowing down on a slippery road is necessary, try to pick out spots in the road that are dry and apply the brakes there. Even then, apply the brakes very cautiously. Where the whole road is slippery, it may help to drive on to the shoulder in order to be on a less slippery surface for braking. But do this only if you know that the condition of the shoulder is favorable.

In open highway driving, there are certain places, at certain times of the year, where unsuspected slippery spots can cause trouble.

Moisture, for instance, quickly changes to ice on a bridge where the temperature is at or near the freezing point. The wind sweeping under or around the bridge evaporates the moisture and causes quick freezing and dangerous patches of ice. Watch for slippery spots on bridges.

Or, in the wintertime, with the temperature around the freezing point, there is another unsuspected source of danger. In rolling country, or in country where there are woods, curves, and cuts through hills, the roadway may be perfectly free of ice where the sun hits it. But just over a hillcrest on a northerly

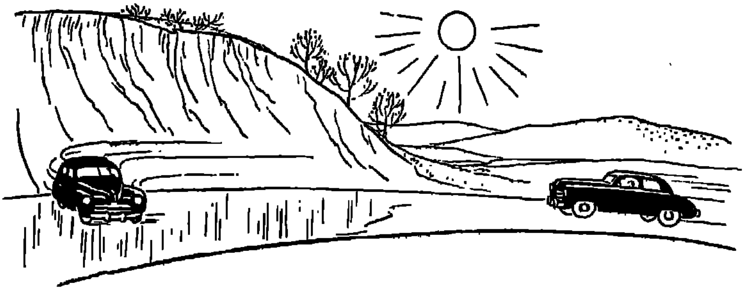

FIG. 213. Slow down for shaded places like this.

slope, or around a bend where trees shade the road, or inside a cut where the sun is kept out, there may be wide sheets of ice. If you come upon such a spot at too great a speed and must stop or steer sharply in an emergency, you may suddenly lose control of your car. In freezing weather, drive at cautious speeds and be on guard against such unsuspected icy spots.

Getting Out of a Skid

If your car starts to skid, you're in trouble, and there are no standard steps which will always get you out successfully. However, here are some steps which are generally wise:

a. Keep YOURSELF under control.
b. Steer in the direction in which the rear end is skidding, but avoid over-steering.
c. *Avoid braking.*
d. Keep the clutch engaged.
e. Don't lift your foot from the accelerator pedal suddenly.

a. **Keep YOURSELF under control.** The advantages of this step are obvious. Whatever is to be done to get out of the skid, *you* must do, and you surely can do it best when you avoid "blowing up." If you cannot control yourself in an emergency, you should not be driving.

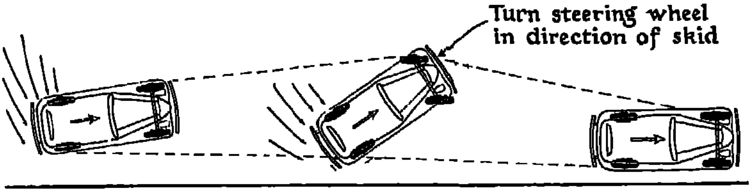

FIG. 214. Steering out of a skid.

b. **Steer in the direction in which the rear end is skidding.** Cut a top view of a car out of cardboard. Draw two chalk lines on the floor to represent a road. Now push the dummy car forward and at the same time start the rear end swinging or skidding to the right. What must you do to the front end to straighten out the car? You must move the front end *to the right*. In the same way, on a real car, you must turn the steering wheel to the right, or clockwise.

The general tendency in a skid is to turn the steering wheel too far. The result is to "whip" the rear end into a skid—perhaps worse than the original one—in the opposite direction. As the car straightens out, you should start straightening out the front wheels.

c. **Avoid braking.** In the midst of a skid, the tendency is to slam on the brakes hard. This locks the wheels and increases the skid by causing a loss of traction. *Fix in your mind the determination to keep your foot off the brake pedal when in a skid.*

d. **Keep the clutch engaged.** Holding the car in gear helps reduce speed and produces maximum control throughout a skid.

e. **Do not lift your foot from the accelerator pedal suddenly.** Lifting your foot suddenly can easily increase the skid because of the sudden braking effect of the engine. Some expert drivers even accelerate moderately, but this is not advisable for beginners.

No training in handling a skid is so valuable as that which helps prevent one. No driver, regardless of how expert he is, does much boasting about his ability to overcome skids. He knows that skidding is always dangerous business and that, as in the case of diseases, prevention is the best cure.

WHEN WHEELS ARE STUCK

When wheels are stuck in mud, snow, or sand, an inexperienced driver usually does the wrong thing. He shifts into first gear and steps down hard on the accelerator. The result is to spin the rear wheels fast and to dig deeper into the slippery material.

Again, prevention is far easier than cure. When it is *necessary* to drive through water or in mud, sand, or snow, *keep the car in motion, if possible.* Traction is much easier to keep than regain. Generally, it is wise to shift into second, for you do not want to go fast, and you *do* want power.

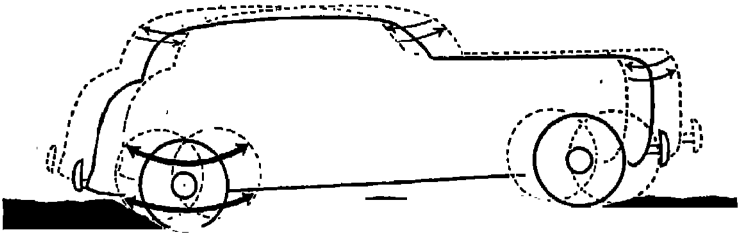

FIG. 215. "Rocking" a car out when it's stuck may be possible if there is hard material for the mired wheels to roll on.

But suppose you get stuck. Keep cool and take your time. If the wheels are not in too deeply and if they are down to hard material, you may be able to rock the car out. This is done by starting slowly in low gear, and then, just at the second when the car will go no farther, shifting rapidly to reverse and rocking back. If, as you repeat such rocking steps in rapid succession a few times, each rock moves the car farther, you may be able to rock it out. Rocking must be carefully done or the sudden shock may break the gears and other parts. It is important that the front wheels be directed straight ahead. You may find it easier to back out in the same tracks than to pull out forward. Attempts at rocking may only spin the mired wheels. In such a circumstance, stop rocking AT ONCE. Your problem now is to create more traction in some way. You can sometimes do this by partially deflating the rear tires, or by liberally using sand, cinders, stones, branches, burlap, or other rough material. Sometimes it is necessary to shovel out in front of the mired wheels and place hard, rough material on a lesser slope for the wheels to climb.

You must create better traction for *both* wheels. Otherwise, because of the way the differential works, the wheel which can still slip will whirl deeper into the mire.

When the rough material is in place, power must be applied *slowly but steadily*. On ice or snow, use second or even high gear to diminish the power of the engine, or use low gear and let the clutch slip somewhat. Then as you move out, you have the advantage of plenty of power to keep going and avoid stalling.

If one wheel is on solid material while the other is mired, the car is just as much stuck as when both wheels are slipping. The procedure to be followed when one wheel only is slipping is essentially the same as that described above.

Use of Tire Chains

Snow and ice conditions demand unusual precautions. Tests by Professor R. A. Moyer, of Iowa State College, and others have shown that good tire chains help very greatly to secure traction for stopping on *packed* snow. The chain links dig in and get a good grip. On ice, chains also help considerably,

especially if the car is well loaded, the tires somewhat overinflated, and the chains so designed that some, but not too many, cross-links are in contact with the ice at all times.

Chains are absolutely necessary at times if you are to move or stop at all where there are substantial grades. On the other hand, some drivers expect entirely too much from tire chains. There are limits to the help which chains can give. The driver's responsibility is to prevent trouble by driving with extreme caution on slippery roads.

UNDERSTANDING ROAD MAPS

Enjoyment of your trip is much greater if you are sufficiently familiar with the make-up of road maps to take advantage of their useful information.

First study the "legend" of a map. This is the map explanation, or the directions on how to read the map. It is generally found in one corner of the map. It shows the scale of miles, explains the symbols and markings, and indicates how to determine the different types of roads.

Generally, maps are so made that, as you face them, the top is due north, the bottom south, the right east, and the left west.

To locate a particular place on a map, first look it up in the map's index of place names. There, after the name, you will find a letter and a number, as B-4, or K-10. The letter and number refer to numbers and letters on the marginal edges of the map. If the point is indexed as at C-1, for instance, as in Fig. 216, find the strip marked C on the margin that contains letters and the strip marked 1 on the margin that contains numbers. Then run your finger directly across the map from each of these two strips until you find the place on the map where the strips would cross. Somewhere in this intersection of the strips you will find the place name—Glade, in this instance.

The scale on a map shows the degree to which the actual size of a portion of the earth's surface has been reduced for picturing on the map. On a road map such as motorists use, the scale, as shown in the legend, is generally a graphic scale, or a bar divided into several equal parts, each part marked according to

the distance it represents on the earth's surface. Usually it is marked in mile units.

The classification of roads, as shown by lines of various widths or colors, generally indicates whether the road is main, secondary, or connecting. The type of road, such as paved or hard-surfaced, improved, all-weather, graded earth, earth, or under construction, is always symbolized in the legend. United States, or Federal, routes are usually shown by a number within a shield, like the shield-shaped route markers on the sides of Federal highways. State routes are indicated on maps by a number within a circle. Some maps show county roads by means of a number or letter within a diamond or circle.

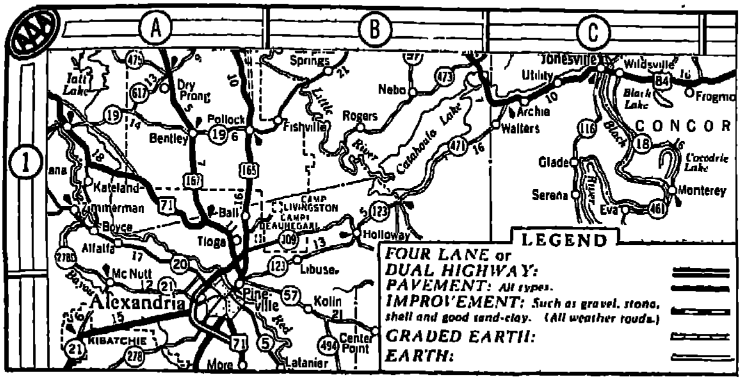

FIG. 216. Having a good map, and knowing how to use it, adds much to the enjoyment, interest, and value of a motor trip. Note how route numbers, mileage indications, and roadway types are designated.

Distances between locations on a map are shown by plain numerals beside the route lines; they indicate mileage between the outlined points or intersections designated by a diamond. See Fig. 216.

By adding the mileage numbers shown along a route you can easily determine the distances from place to place.

Learn to read a road map with ease and make use of the interesting and valuable information generally found on reverse

sides of well-constructed maps. This information greatly increases the comfort, interest, and value of your trip.

Maps should be consulted by drivers only when the car is not in motion. If you are driving and have to consult a map after your trip is under way, always stop your car entirely off the roadway.

DISCUSSION TOPICS

1. Accidents frequently happen because one car follows another too closely. Have you heard of such an accident? Discuss the circumstances.
2. Why should the "following distance" increase with increased speed? What effect does darkness have on the proper "following distance," and why?
3. When you are traveling on a three-lane road, what are the special dangers of passing near hillcrests? On curves? *How should the road be marked at such places? What signs should be set up?*
4. Make a list of the major discourteous acts of which a driver can be guilty on a hill; on a curve; on a straight, level road. In class, discuss their relative seriousness.
5. What can a driver do to avoid or decrease the special hazards involved in changing a tire or doing other work around the rear of his car on the open road at night? Suppose he cannot draw entirely off the pavement. Then what should he do?

PROJECTS

1. Find out if possible what proportion of rural traffic fatalities in your state occur on straight roads; on curves; on hillcrests; in overtaking and passing? What driving faults or violations are most involved in such accidents? Summarize your findings.
2. Prepare a list of ten sound driving habits for the open highway, putting first the ones you consider most important. Watch drivers while riding with them and check their mistakes against this list. Do different drivers have about the same bad habits, or is there great variation?
3. Field checks, made by Dr. H. C. Dickinson, of the National Bureau of Standards, and others, indicate that if car B is following car A at A's speed and at a normal distance, it will take an absolute minimum of 7 seconds for car B to overtake and pass car A and get back into position in front of car A, almost regardless of the original speed of cars A and B. Check this for yourself, letting a friend operate a stop-watch. Write down findings from your tests. Why then is a passing time of 10

seconds used in connection with Fig. 201? How can you make this study useful in *your* driving?

4. Draw a diagram indicating by variation in the width of a band the proper speed variation as a car approaches and goes over a hillcrest.
5. Draw a fairly accurate plan of a familiar intersection of two roads where there is some obstruction to vision, such as a house, shrubbery, or tall corn. If one is traveling 45 m.p.h. in such a direction that the obstruction to vision is most serious, how much do you estimate that he should reduce his speed as he nears the intersection? Assume that the road is level and dry. Write out your assumptions and reasons.
6. Secure samples of well-constructed state and sectional road maps and strip maps and study them until you understand all they show. Then plan a trip of about 100 miles and list the important things about this particular trip that you are able to learn from the map.

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CHAPTER XVIII

City Driving

Do You Know:

The special hazards in city driving?
What determines sound speeds in city traffic?
What the correct car positions in city traffic are?
How to reduce hazards at intersections?

GETTING THE CAR INTO THE STREET

A DRIVE from the garage at home to a parking space downtown is likely to call into play a number of special driving skills.

In the usual home and garage set-up, cars are backed to the street. This position creates a major hazard—the danger of not seeing someone or some object in the path of the backing car.

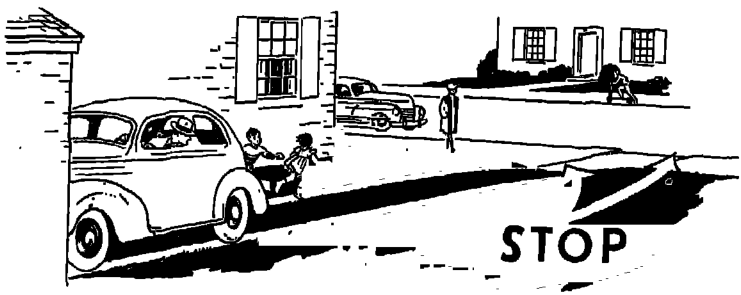

FIG. 217. Why is double-stopping desirable? Name all the hazards involved.

Take precautions to lessen this hazard as much as possible. Adjust the rear-view mirror to give a full view of the driveway. Be sure the back windows are clean, and lower the window beside the driver's seat so you can put your head out to see better.

If children are playing in the yard, see that they are in a place where they can be watched while the car is in motion. Children cannot be depended upon to look out for themselves. Before backing, touch the horn as a warning.

Double-stopping is good practice, if you must cross a pedestrian walk. Stop first before crossing the pedestrian walk and again at the curb. Pedestrians on the sidewalk have the right-of-way over a car crossing from a private driveway, and vehicles on the public roadway also have the right-of-way over a vehicle *entering* from a private driveway.

If you live on a quiet residential street, back into the street *gradually*, turning the car as you back so that it is headed in the direction you wish to go. If the street is wide or traffic on it is heavy, ease slowly back into the nearest lane and proceed in the direction of its flow—even if you want to go in the opposite direction. It is better to go around the block than to back across traffic to the tune of screeching brakes, honking horns, and provoked drivers.

DRIVING IN TRAFFIC

In traffic, your mind must work as fast as the mind of the fastest running halfback in football. Close situations are arising rapidly; the whole pattern of movement all around you is constantly changing; objects are constantly shifting; there is no time to sit comfortably back and think of your next move. You think "on the run," make decisions, and act quickly. It is a matter of seconds and split-seconds. Slower speeds, safe following distances, skilful techniques, good driving habits, wise

FIG. 218. Busy streets! Quick decisions! Skilful techniques!

judgments, quick decisions and courtesy are your best assurances of safety.

When coming from the open highway into more populated sections, you cannot judge safe speeds by the "feel." This is the time to let the speedometer be the judge, even though, by contrast, you seem to be merely "crawling along." Pedestrians, more cross-streets, greater congestion, and other factors in built-up sections require a shorter stopping distance.

When moving with a stream of traffic, the driver must consider two factors all the time: (1) car position, and (2) speed. How fast should he be going, and where should he keep his car in relation to other cars and to the turns he wishes to make?

Sound City Speeds

When your car is out of the driveway and you are moving with the stream of traffic, you must consider what is a "reasonable *speed.*"

In any stream of traffic, a normal rate of flow is set by the traffic conditions at the time. Traffic moves more smoothly and easily if all drivers adjust themselves to the normal rate.

If the street is too narrow to accommodate two lines of moving traffic in each direction, a slow driver causes annoyance to all drivers behind him. But even more annoying is the driver who tries to hurry ahead, cutting in and out of his line, getting on the wrong side of the road, and making it necessary for approaching cars to slow down or stop.

At times you may have need to hurry. When hurrying is necessary, save time, if possible, by using a little longer but less crowded route.

On a street where traffic is light and there are no special controls, each driver has considerable freedom in deciding what speed he shall use. No one can say that any particular speed is the right speed for city driving. Under some circumstances, 25 miles an hour might be much safer than 15 miles per hour under other circumstances.

Correct speed for city driving is difficult to define. It is a speed in line with the present traffic conditions and within the

local traffic regulations. The simple guiding principle might be summed up in this way: *Sound speed is speed always so controlled that the vehicle can be stopped before hitting any other vehicle or pedestrian that is likely to get in the way.*

So the question becomes one of realizing how pedestrians and other vehicles are likely to get in your way.

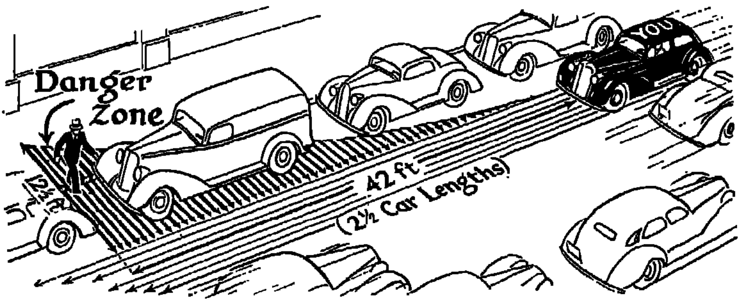

FIG. 219. Danger zones extend to the sides as well as straight ahead.

A car's danger zone extends to the sides. You may be able to stop in what seems to be the clear distance ahead, but someone may suddenly walk or drive into your path from the side within that "clear distance."

The shaded area in Fig. 219 represents the danger zone for pedestrians. If your car is going 20 m.p.h. and any pedestrian in this zone walks toward the path of the car at 4 m.p.h., he will be hit. Even though your reaction time is ¾ second, and your car has good brakes, you will have no control over the situation. Your car cannot be stopped within the distance given, and there is not sufficient room to swerve to the right or left.

As speed increases, the danger zone not only lengthens but increases in width as well. In order to be relatively certain that no one will walk into the path of your car, you *must be able to see the entire area of your danger zone* at all times. If visibility of the zone is obstructed by parked cars, then you must drive farther away from the parked cars, or decrease the size of your sidewise danger zone by a reduction in speed. See Fig. 220.

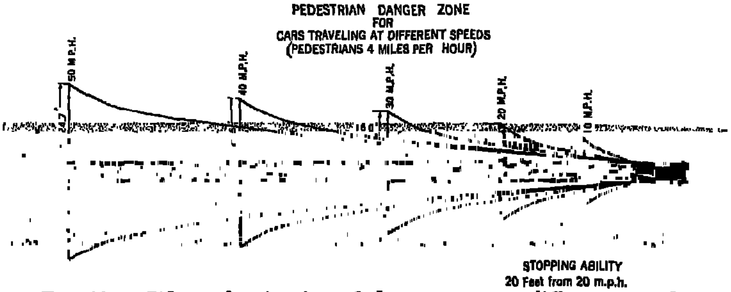

FIG. 220. Sideward extension of danger zone at different speeds.

Correct Speed in a "Progressive Signal System"

There are some city streets on which the proper vehicular speed is fixed by what is called a *progressive system* of stop-and-go lights. On such a street, the signals are so timed that a driver moving at exactly the indicated speed will have the signal ahead turn green as he nears it, so that he will not have to stop at all. The too fast and the too slow driver will be caught on a red light at certain intersections and will have to wait for the green light. It's easy to see that the only satisfactory speed in such a system is the speed for which the lights are set. You can't beat clockwork, and the driver who doesn't "keep in step" with such a signal system simply advertises his lack of common sense.

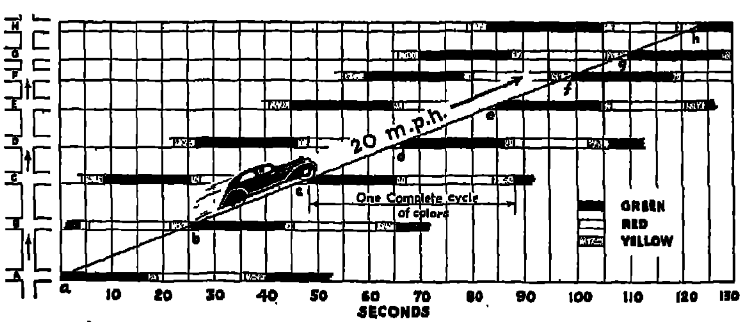

FIG. 221. Progressive traffic signal systems are "set" for certain speeds. For example, in this chart, the signals are so timed or set that a car going 20 m.p.h. will reach intersection A, B, C, etc., just as the signals at those intersections change to green, as shown at a, b, c, etc.

Speed Control at Intersections

At *every* intersection there should be some reduction in speed. The lowest speed should be reached at approximately the nearest crosswalk. This applies even to a car on a "through" street approaching an intersection where there is no obstruction to vision, for a car from the opposite direction may suddenly turn left.

Under favorable conditions, only a slight reduction in speed is necessary in approaching an intersection. But until you are sure that no other highway user can interfere, adjust your speed to enable you to *stop short of the intersection* if necessary.

It is impossible to specify *one* safe speed for all intersections. There are too many varying conditions. So, for speeds in city driving, adopt the general rule for sound speed that has already been given on page 313.

As long as you observe this rule, you have control and can avoid trouble. See Fig. 222.

Intersections are places of special hazard, and those which look safe but involve unnoticeable hazards are "trouble-makers." The greater the possible hazard, the less the permissible speed.

Keeping in One's Lane

Some streets are marked off into traffic "lanes" by lines painted on the pavement. A city street marked to carry two lines of moving cars in each direction, in addition to parking at the curbs, is not uncommon. On such a street there are six traffic lanes. Where streets have no such markings, the expert driver imagines them to exist and places his car accordingly.

Every car on the street ought to be definitely in one lane or another, or moving carefully from one lane to another, when a turn is being made or the speed of the car changed.

The skilled driver does not wander aimlessly over the roadway. He drives in the right-hand lane, if he wishes to drive more slowly than other traffic, in the left, if he wishes to move faster. After he has passed a slower-moving car, he *works back to the*

right-hand lane, unless he is almost immediately going to overtake another car or make a left turn. This keeps an empty lane on the left so that faster moving cars can overtake and pass.

When the volume of traffic is *light*, you can keep some distance away from parked cars. This reduces the hazard of hitting pedestrians who might step out from between parked cars, or vehicles suddenly pulling out from parking spaces, or drivers who thoughtlessly get out of a parked car on the street side.

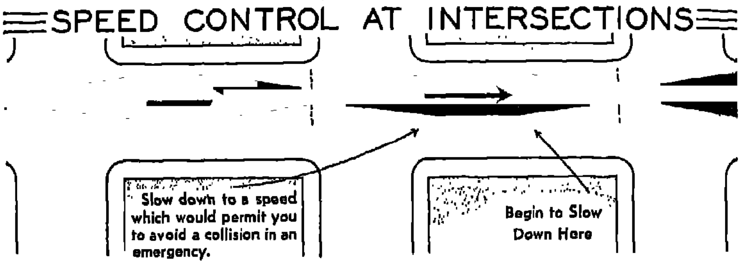

FIG. 222. Study this chart. Speed varies with the width of the band.

Making Right and Left Turns

Always make turns from the correct lanes. Otherwise, you are an out-of-order driver conspicuously confusing the proper traffic pattern.

Preparations for turning right or left in city traffic should *begin* two or three hundred feet before reaching the intersection. The car must be in the proper lane for the turn when it reaches the intersection.

Right turns should *always* start from the right hand traffic lane and, if possible, end in the right-hand traffic lane of the cross street.

The heavier and faster the traffic, the greater the distance required to work into your lane—and the longer in advance your hand signal should be given.

The same system of hand signals should be used in making right and left turns and slowing down on city streets as was described for open highway driving on page 293. When you

give correct signals, well in advance, you give other drivers a fair chance to adjust their cars to your intentions.

Turns should be made at low speeds. All that was said in the preceding section about having the car under control at intersections applies even more urgently to turns than to "straight through" movements. For turning in city traffic is a more complex operation and is likely to involve more drivers and pedestrians than straight through driving.

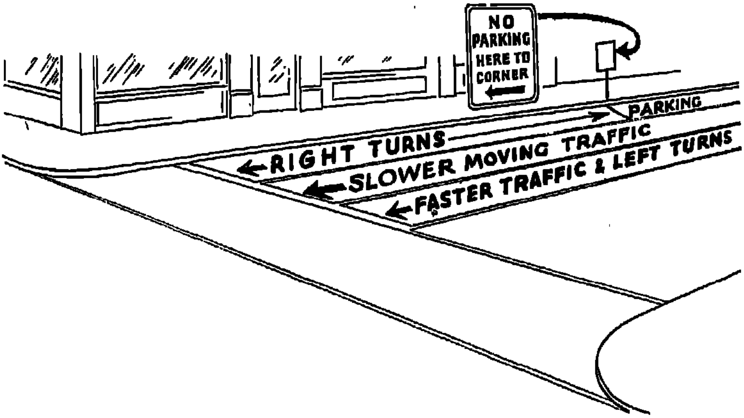

FIG. 228. Car positions on a six-lane roadway.

When to Overtake on the Right

In the discussion of the rules of the road in Chapter X, it was said that, in overtaking, one should pass to the left. There are exceptions to this rule.

When two fairly continuous lines of traffic are moving in the same direction, it would be undesirable for the entire right-hand line of cars to stop if, for any reason, the left-hand line were delayed. So each line of vehicles moves independently of the other without confusion, provided no abrupt, unexpected transfer from one lane to the other is made.

When a vehicle is about to turn left at an intersection, it may be passed on the right-hand side. In some states, passing on the right is permitted under certain other specified condi-

tions. Check this rule for your state. If you are ever in doubt, however, *overtake only on the left.*

Intersections

City intersections are all alike in some respects:

1. The roadway is used by conflicting streams of traffic.
2. Both pedestrians and vehicles use the roadway and must adjust their actions to one another.
3. The actions of each driver are especially affected by the actions of other drivers.
4. There are many opportunities for mistakes in judgment and for disregard of the rights of others.

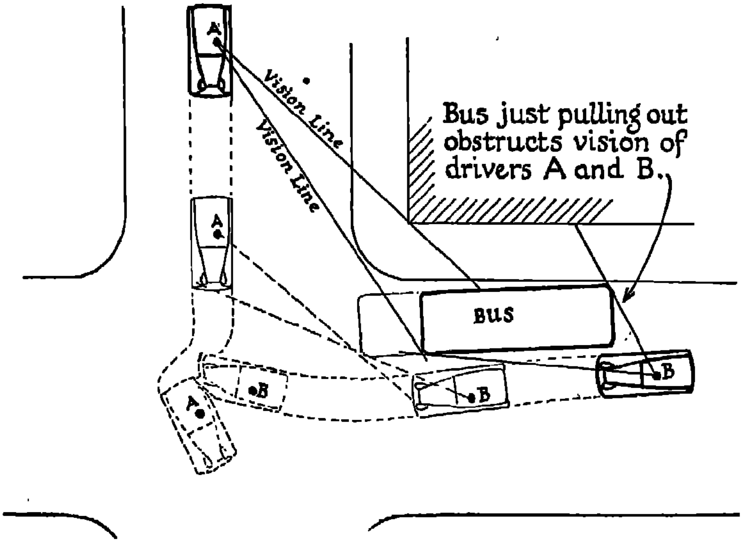

FIG. 224. Note how the bus blocks each driver's view of the other car until it is too late.

There are, however, important ways in which intersections differ, and drivers have to determine sound driving practices in terms of the special conditions at each intersection.

Intersections are of several types: (1) those controlled by stop-and-go lights or by an officer; (2) those where "through"

streets cross "side" streets; (3) those with no traffic control, where everything is left to the judgment of individual drivers.

There are intersections with no obstructions to vision. And there are "blind" intersections where shrubbery, or parked cars, or buildings make it impossible to see what is across the corner until one is very close to the cross street. In addition to the customary right-angle intersection of two streets, there are "T" and "Y" intersections, odd-shaped intersections, and "multiple" intersections where more than two streets meet.

With all this variation in conditions, each intersection must be considered as a separate problem.

The "blind" intersection is the one that is liable to cause the most trouble unless special care is taken.

Suppose you approach an intersection at the side of a trolley, bus, (Fig. 224), or large truck. Your full view of certain pedestrians or cars is now cut off. The situation calls for extreme care. If you enter or cross the intersection ahead of the large vehicle without extra care, you invite a crash. If you allow yourself to speed ahead driving "blind", the result can easily be a collision with another car or an injury to a pedestrian.

Crossing Street Car Tracks

In city driving, you sometimes have to follow along street car tracks for long distances. A wrong technique in crossing street car tracks can easily cause an emergency.

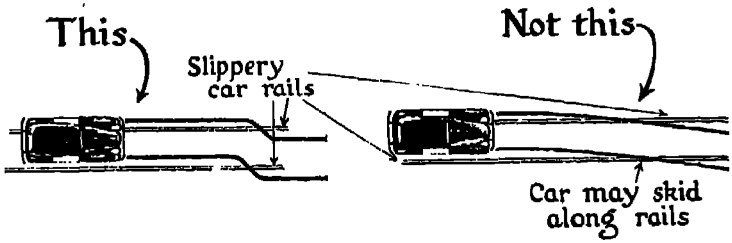

FIG. 225. Trying to cross slippery rails when the wheels are nearly parallel to the rails may cause a serious skid.

Crossing car tracks from a too-parallel position is liable to cause the car to skid, especially if the street is slippery. For this reason, it is best to drive entirely off the tracks or to straddle one rail. When you must cross car tracks, bring your car to a low speed and turn the wheels across the tracks at a rather wide angle. As soon as the wheels have crossed the tracks, straighten them immediately. Be sure there are no other cars close enough to interfere with this maneuver. Fig. 225 shows the best path to follow.

Parking

Parking the car on city streets is one of the special demands of city driving. The correct techniques for parking and for pulling out from the curb after parking have been described fully in Chapter XV on Maneuvers, page 253. It is not possible to be a good city driver without *mastering* these parking maneuvers.

Hand signaling is a definite part of good parking. Move carefully into the correct lane, giving the "slowing down" signal well in advance. Use the rear-view mirror to be sure the signal is understood by drivers who are following. Then gradually maneuver the car into the parking place. Approach the curb slowly and with special care. Striking the curb hard is bad for both tires and steering mechanism.

In pulling out from parking, as in all driving on city streets, the fundamental sound practice is to make certain that your path is clear and that other drivers are aware of your intentions. Unbattered fenders may well be a matter of personal pride to a driver. They announce the fact that many correct judgments have been made. This is especially true if the car has long been used in heavy traffic.

DISCUSSION TOPICS

1. Are you ever justified in overtaking and passing other cars within street intersections? Consider streets with varying numbers of lanes, cars of different sizes and speeds, different types of intersections.

2. Agree on a list of ten intersections in your community that show unusual driving difficulties. Rank the intersections in degree of difficulty and explain the ranking.
3. You approach an intersection just as a street car is also approaching it from the same direction. You are slightly behind the street car, but by speeding up you can pass it before it stops to take on passengers. There is no safety zone; the passengers are standing at the curb. Should you slow down? Stop? Or is it sound for you to speed up and get by the street car before it stops? Explain. Does your traffic law have any provision covering this situation? If so, does it seem reasonable?
4. Do you think that your traffic regulations should permit right turns on a red light? Do they permit or forbid them? Is a green turning arrow used? Discuss the advantages and disadvantages of this plan, giving due consideration to its effects on *pedestrians*.
5. Consider the places on the streets of your community where parking is forbidden. Do the restrictions seem wise?
6. It is a common practice in some communities for drivers to park their cars, for a minute or two, on the left side of the street while they get a paper at the news-stand or unload passengers at theaters, stores, etc. Is there justification for this practice? Have you ever observed difficulties caused by this practice?

PROJECTS

1. A driver pulling out from the curb carelessly goes too far out into a street that has only one moving lane in each direction. Draw a diagram indicating the hazards to passing vehicles.
2. Select a street corner in a residential district where traffic is free to move at comparatively high speeds. Watch cars making right and left turns. Note the cars making right turns that start wide from the curb and swing wide to the wrong side of the street into which they are turning. Does this practice seem to be due to excessive speed, to length of vehicle, or to the driver's carelessness in laying out his course? Note the added hazards when drivers "cut the corner" in left turns. Report on your observations.
3. At the same corner, observe whether or not consideration is shown other street users. Note such practices as turning without signals, turning from wrong lanes, and *disregarding pedestrian rights*. How does the attitude of the average driver of your community impress you on this matter?

4. Select a street in your community where many cars are parked. Observe how drivers, pulling out from parking spaces, signal, look, gradually "nose" into the stream of traffic, and keep in the proper lane. What were the most frequent unsound practices?

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CHAPTER XIX

Giving the Car a Square Deal

Do You Know:

- **How to keep safety devices in good condition?**
- **How to keep your engine working efficiently?**
- **What care is needed in winter weather?**
- **How to operate your car economically?**

KEEPING THE CAR IN PROPER CONDITION

A PROMINENT surgeon declared that a large percentage of his patients arrived at the hospital because they had failed to take care of themselves. "The human machine," he said, "doesn't always get a square deal."

FIG. 226. The owner, not the car, deserves the blame for poor performance.

The same thing might be said of automobiles. Plenty of sick cars arrive sooner or later at repair garages because their owners do not give them a square deal.

Forty-nine good drivers, representing each state and the District of Columbia, were found to have driven an accumulated 15,000,000 miles without crashes or traffic convictions. They obviously knew how to keep out of driving troubles. They were asked to list the main reasons for their excellent driving records. *Keeping the car in proper condition led the list.*

Drivers who pile up astonishingly good performance records always keep their cars in sound condition, ready to perform. They give you three general reasons for taking good care of a car:

1. Greater assurance of safety
2. Increased economy in car operation
3. Greater pleasure in driving

Railway locomotives, airplanes, steamships, elevators, bridges, and buses are given *periodic inspection* to assure their condition for safe, efficient operation. In some states, systematic inspection of the safety equipment of private automobiles is required by law. Everywhere, it is required by common *sense.*

A larger percentage of cars on the road have safety equipment in need of repair than is generally realized by the public. This is especially true since the period of the war made replacement of certain worn-out parts all but impossible.

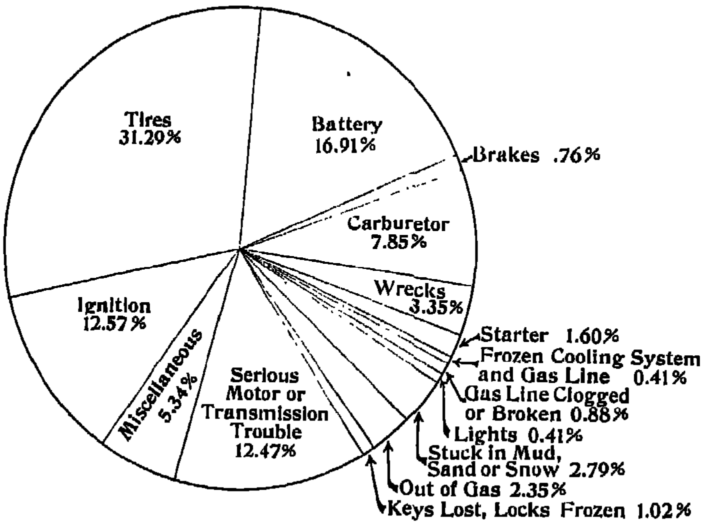

FIG. 227. Causes of car failures as revealed in a survey by the American Automobile Association of over one million service calls during 1946.

Even though driver deficiencies may still be responsible for a much larger percentage of accidents than car deficiencies, there is every reason to keep the car in such a good condition that the number of accidents caused by car defects will drop lower and lower.

The time needed for regular car inspection is short, and inspection is an economy measure for owners. The cost is very low to each owner, especially when compared with the costs of repairs after neglect.

CARE OF SAFETY AND CONTROL DEVICES

1. Brakes

When you speed up your car and thus increase its kinetic energy, or the energy which exists because of the car's motion, you show great confidence in your brakes. The higher your speed, the greater your confidence must be! For, the greater the speed, the more powerful must be the braking to use up the energy and stop your car.

In an emergency stop, your brakes have to exert a much more powerful force than your engine. To have an idea of how true this is, pull on the relatively weak parking brake and try to start the car against it. *Brakes are made to hold.*

Confidence in brakes implies that they are in sound condition —fully ready to perform. Unfortunately, such confidence is sometimes woefully misplaced. Ask any inspector at a good inspection station and he will tell you that *faulty brakes are found on nearly one-third of the cars tested,* according to easy standards of testing. In fact, inspection stations find deficiencies in brakes more often than in any other equipment except headlights.

Brakes are sound when they satisfy all of the following requirements:

1. They must be so adjusted that their grip on all wheels is equalized. This statement means that the braking force developed at all four brake drums is exercised at the same time and with equal force. This condition brings the car to a smooth stop with no swerving, side-slipping, or

skidding, because all tires have an equal grip on the pavement, assuming there are no slippery spots on the pavement which reduce the grip of one or more tires.

2. The brakes must stop the car within safe standards of braking distance. See Table II, Chap. V.
3. The brake linings must be even, dry, free from grease or sand, and not unduly worn.
4. The brake drums must not be warped from overheating, scratched because of sand, or scored by the rivets in worn-out linings.
5. The brake pedal cannot be depressed closer to the floor boards than about an inch and a half.
6. With hydraulic brakes, continuous hard application must not result in a gradual lowering of the brake pedal.

Improper adjustment of brakes often causes excessive wear on tires and brake bands. With "dragging brakes," one or more brake bands may be in contact with the brake drums all the time, even when the brake pedal is not depressed. This condition holds back one or more of the wheels while the others are rolling freely. The result is extra wear on the tire of the wheel with the dragging brake, plus a rapid wearing out of that brake band. To avoid this hidden cause of tire wear, have your brakes adjusted several times a year by a competent mechanic.

Testing the Brakes

Here is a simple method that anyone can use in testing four-wheel brakes. Try this on a hard, smooth surface, *away from traffic,* and at a slow speed of about 10 m.p.h.

Press hard on your brake pedal to stop your car as quickly as possible. All the four wheels should lock. Inspect the tracks made by the tires to see whether all skid marks are the same length, indicating that the brakes on each wheel took hold at the same time. If the marks show that the car tended to skid or swerve to one side, the brakes are not properly equalized and need immediate adjustment.

Brakes should be tested after you have forded a stream, after you have driven through slush or heavy rain, or if the car has just been washed. Wet brake linings cannot be trusted to

hold evenly. If they are wet, dry them by gently applying your brakes while driving slowly, in low or second gear if necessary, until they feel normal.

If a hard application of your brake pedal brings the pedal within less than an inch of the floor-board, take your car in for brake adjustment, or, if it has hydraulic brakes, for new brake fluid.

Squeaking at the wheels may mean that the brake linings are worn down to the rivets, which squeak when they rub on the brake drums. Or it may mean that the surface of the brake lining is glazed from burning or overheating. Grabbing brakes may indicate warped drums or dirt on the linings. "Chattering" is sometimes a clue to warped drums.

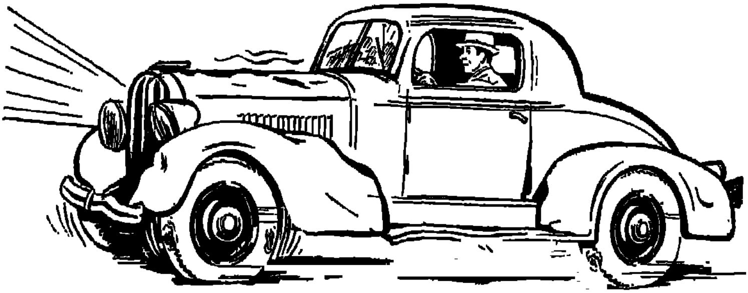

FIG. 228. Keep your own house in order. How many defects in the car are illustrated here?

Proper Brake Care

The sportsmanlike driver takes proper care of his brakes by:

1. Having them inspected regularly.
2. Having brake system adjusted and equalized by expert mechanics.
3. Prompt replacing of worn or damaged linings or worn linkage.
4. Maintaining sufficient hydraulic brake fluid in hydraulic brake systems so that there is no fading.
5. Preventing over-greasing or improper greasing in the differential and in wheel packings. If grease works out into the brakes, they become inefficient.

6. Avoiding over-use of brakes. The "brake driver" is hard on the braking system and on the tires. He alternately goes too fast and then slams on his brakes. Over-used brakes betray inexpert driving.
7. Avoiding sudden stopping. Sudden stopping is hard on brakes and tires. It is not necessary if you "drive ahead" so that you know what the traffic conditions are, and if you keep your car in constant control.
8. Having tires with good treads, and keeping them properly inflated so that braking can be effective.

Brakes are not crude mechanisms. They are very closely adjusted when the car is made. Brake bands are made to clear drums with the close precision of a few thousandths of an inch. When bad usage injures parts or destroys this delicate adjustment, braking efficiency is definitely reduced.

Proper brake maintenance pays the sportsmanlike driver big dividends. Give your brakes a square deal!

2. Tires

In prewar times, tires were so readily available and at such attractive prices that prolonging tire life did not have the important place that it has today. But the shutting off of our foreign supplies of crude rubber—our only source in the past—made rubber both a critical war material and an extremely scarce commodity for civilian use until we created our own supply of synthetic rubber.

During the war years, drivers had to learn how to conserve their tires and get the maximum mileage from them. Now, with the war over, tires are more plentiful but still expensive. So it is just as important today to observe good tire conservation practices, if you want to operate your car with good economy at the minimum tire cost per mile.

Avoiding Tire Trouble

Correct air pressure in all tires is one of the most important ways of avoiding premature tire failure. Make a check at least once a week to see that the pressure is right in all your tires, including the spare.

Frequent checking of tire pressures is the cheapest and one of the best forms of tire care. Under-inflated tires wear out sooner, make steering harder, and cause the brakes to work unevenly.

Some of the troubles caused by under-inflation are:

1. Damage to the side-walls of the tires because of over bending, too much internal heat, and too great a strain on the side-wall fabric from bumps. Blow-outs can easily result.
2. Hard steering.
3. "Side-rolling" on curves and irritating squealing on turns and sharp curves.
4. Wasting of gasoline.
5. Greatly reduced tire life due to increased rate of wear.

Troubles caused by excessive over-inflation are:

1. Increased possibility of blow-outs in a weak tire.
2. Extra wear on the middle of the tread.
3. Somewhat decreased road grip.

Badly worn tires are always trouble-brewers. When tires are worn down to the fabric, sharp objects in the roadway easily penetrate the thinner material. There is the constant threat of a puncture or blow-out, which means a hazard, not only to the driver and his passengers, but to everyone near on the highway. Drive very slowly if you must use worn-down tires.

Few prewar motorists used second-hand, reconditioned, or retreaded tires. But during the war the scarcity of crude rubber made retreading a major source of relief for those with worn tires. The art of retreading has made tremendous strides in recent years. And if the "carcass" of the tire is sound, retreading is quite satisfactory when it is expertly done. But if the fabric or cord structure is worn or broken, retreading is a likely trouble-brewer, unless these breaks are expertly repaired beforehand. It should always be done before the fabric or cord is exposed.

Regrooving, which is a process of cutting deeper tread patterns into worn tires, is inadvisable. It wastes the amount of

rubber removed, weakens the tread, and frequently injures the cord structure.

Good tires are such a valuable asset that every car owner and driver will find the following rules worthwhile:

1. DRIVE AT REASONABLE SPEEDS. Tires will go twice as far at 30 miles per hour as at 50 miles per hour. High speed is much more harmful to tires in hot weather than in cold. Tire tread wears five times faster at 100 degrees than at 40 degrees. Go especially slow on roads with sharp projecting stones. *Take curves and turns slowly.* Speeding around curves *multiplies* tire wear—as much as ten times in some cases.
2. NEVER LET TIRE PRESSURE GET BELOW THAT RECOMMENDED. Even slight under-inflation increases rate of tire wear considerably. Six pounds under-inflation for a tire which should carry 30 pounds pressure will cut tire life at least 20%. See that each tire has its valve cap screwed on tightly.
3. NEVER DRIVE ON A FLAT.
4. AVOID STRIKING CURBS, HOLES, ROCKS, ETC. Anything which produces a sudden sharp bend in the casing—especially if the tire fabric is crushed between the rim and a hard object—is likely to snap cords within the tire, and then other cords break around the unseen weak spot, and the tire fails. Cuts or bruises in the sidewall will also greatly shorten tire life.
5. INSPECT YOUR TIRES WEEKLY. Examine them closely to see whether blisters or bruises have developed on the sidewalls. Look also for tacks, bits of glass, stone, or sharp pieces of metal which sometimes become imbedded in the tread or in weakened spots. Remove all such objects with pliers or screwdriver, being careful not to damage the tire further. If sharp objects have left small cuts in the tire, have them sealed or vulcanized at once. Minor cuts tend to grow deeper. Water and grit work into these flaws and will later destroy the cord structure inside the tire.

While inspecting tires, notice the manner in which the tires are wearing. For example, if there is a wavy wear on the outer edge of the front tires, it is an important clue to a misalignment in the steering system which needs immediate correction if further tire wear is to be avoided. The causes of any unusual wearing condition should be investigated and repaired to prevent tire waste.

6. AVOID JUMPING STARTS AND SCREECHING STOPS. They scuff off much more tire tread than many realize. One ten-foot skid takes scores of miles off tire life.
7. KEEP BRAKES ADJUSTED. No one tire should do more than its share of braking.
8. SWITCH WHEELS, INCLUDING SPARE, AT REGULAR INTERVALS. Switch oftener as tires become worn. This will assure approximately even wear on all tires and increase tire life. Several switching plans have been advocated. The most important point is to get each tire used in each position. *Know what switching plan you are using and stick to it.*
9. HAVE WHEEL ALIGNMENT, "PLAY," AND BALANCE CHECKED TWICE A YEAR. Wheels out of line can shorten tire life one-quarter to one-half. Too

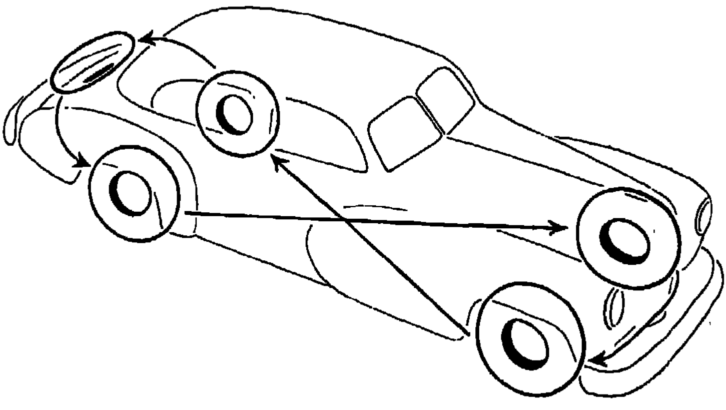

FIG. 229. In switching tires, be sure each tire is used in each position. Select a good switching plan and stick to it.

much "play" in steering systems causes spotty wear of tires. When a wheel is out of balance, there is a pounding or shimmy effect which wears the tire unevenly.

10. USE TIRES OF PROPER SIZE AND DO NOT OVERLOAD CAR. Too much weight on the tires will cause excessive wear.
11. KEEP OIL AND GREASE OFF TIRES. They deteriorate or rot the rubber.

How much can tire life be increased by following these rules? In a pre-war survey of 56 cars of the same make and model, using the same brand of tires, the driver who was *hardest* on his tires got only 10,500 miles while the driver who was *easiest* on his tires got 36,900 miles.

Changing a Tire

Changing a tire should be done *with the car entirely off the paved surface of the highway*, and, if possible, on a level spot where the shoulder is hard. At night, be sure that nothing hides the lighted tail light.

When the car has been moved off the road:

Put the hand brake on hard.

If there is any grade, block one of the wheels with a sizeable stone.

Jack up the bumper, axle, or wheel rim, depending on the type of jack you have, being sure that the jack rests on flat, solid ground, or on a flat stone, or block of wood, if the ground is soft. Know your jack; know how it operates before you must use it in an emergency.

Pry off the hub cap cover. Remove the several nuts which hold the wheel on, being careful not to lose any.

Put the spare on in place of the "flat," and tighten all the nuts hard and evenly. Replace the hub cap firmly.

Fasten the "flat" securely in the "spare" position. Lock it on the spare carrier, or in the trunk compartment, to prevent theft.

Let the jack down carefully. Be sure all the tools are

picked up and put away. Remove the stone used to block the wheel.

Patching a Tube

If you have no spare, you may have to fix your own flat! A tire pump must be available—also a tube repair kit and tire tools.

If the tire is not entirely flat, test the valve by covering the valve-stem opening with saliva. If it bubbles, tighten the valve core with the keyed top of the valve cap, or insert a new core and recheck.

If a valve leak is not the cause of your trouble, jack up the wheel, or, if necessary because of fender design or serious traffic hazard, remove the wheel.

Examine the tire all the way around for nail, glass, or other evidence of puncture. Using pliers, or a small screwdriver, pry or pull out any nails, glass, stone, etc. Mark the tire casing at the positions of the valve and the puncture. Then when the tube is removed, the location of the puncture can easily be found. Remove the valve core and put it in a safe, clean place.

Using tire irons, carefully pry one "bead" of the tire casing off the rim all the way around. Push the valve stem back through the hole in the rim. Then pull out the tube carefully, in order not to damage it. Replace the clean valve core and pump up the tube until it is firm, or slightly larger than the size of the tire. Find the puncture. Rotate the tube close to your ear, listening for a hiss from the leak. Turn over the tube and repeat. Another method of locating the leak, if a large container of water is available, is to immerse the tube, one section at a time, until bubbling is observed. The tube must then be dried near the leak.

Mark the location of the puncture. Remove the valve core again. Then, using rough sandpaper, or some scratching article; roughen the tube surface to be covered by the patch. Prepare the patch and stick it on tightly, following carefully the directions with the patch kit. Such "cold"

patches are not satisfactory on synthetic rubber tubes. In an emergency a "cold" patch may be applied for temporary use, until the tube can be vulcanized. Pump the tube until it is firm, and inspect it again to be sure the leak is stopped.

Now feel carefully with your hand all around the inside of the tire casing for any sharp points (tacks, glass, etc.). Also remove any dirt, pebbles, etc. If there are any broken or loosened cords inside, a blowout patch or inner-liner must be inserted temporarily until proper repairs can be made.

Partly deflate the tube and replace it in the casing. Line up the valve stem with the hole in the rim and pull the stem all the way through. (*Some tires have a mark,* usually a red dot, which should be lined up with the valve stem.) Pound the bead of the casing back onto the rim, being careful not to pinch the tube or to bruise the casing while pounding.

Pump up the tire to about 10 pounds pressure, and bounce it moderately on the road or ground. This bouncing gives the tube a chance to take its normal shape in the casing, eliminating any wrinkles or air pockets. (Additional steps must be taken to install a synthetic rubber tube properly. Manufacturer's instructions should be carefully followed.) If the wheel is not removed, deflate the tube again, permitting it to find its true position. When synthetic tubes are used, this deflation and reinflation process is most advisable.

Then pump in the required pressure and replace the valve cap.

Let the jack down carefully. Be sure all tools are picked up and put away.

3. The Steering Mechanism

Consider how much you depend on the steering mechanism. You roll blithely along at 35 m.p.h. with only three feet or so separating your car from a line of cars zooming by in the

opposite direction at equal speed. About three feet—and a 70 m.p.h. total meeting speed! There's confidence in the steering equipment for you! It had better be in good condition!

The checks and adjustments in the steering assembly are so intricate and numerous that they should be made only by an expert mechanic. But every driver can learn to recognize the symptoms of troubles developing in the steering mechanism and can realize how important it is to have adjustments made at once.

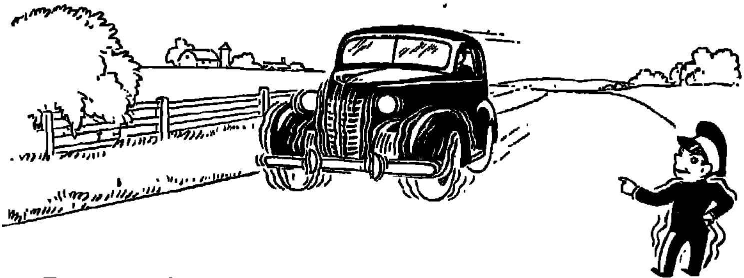

FIG. 280. When your front wheels "shimmy" it's not only disagreeable, but dangerous and costly.

Steering troubles that always need investigation are:

1. Too much "play" in the steering wheel. If you can turn the steering wheel so that the rim moves more than two or three inches without starting to move the front wheels, there is too much "play" and an adjustment is needed.
2. Hard steering. This may be due to unequal or underinflated tires, need of lubrication, improper wheel alignment, or worn or improperly adjusted parts. If the steering is hard, check the tires and the wheel lubrication at once.
3. "Shimmy". A tendency to "shimmy" suggests at once a need to check the tire inflation and wheel balance. If this does not solve the trouble, a mechanic is needed to tighten connections, correct wheel alignment adjustments, replace worn parts, or balance the wheels.
4. A tendency for the car to wander from side to side, or to turn persistently to one side, even though air pressures

are equalized, indicates improper wheel alignment, which also causes very rapid tire wear.

No one can afford to put off consulting an expert mechanic when symptoms of trouble in the steering mechanism develop.

In winter weather, there is a special caution to take. If you have been driving for a long time on a straight road and the temperature is just above freezing, there is a danger that the front wheels will throw quantities of slush-ice up under the fenders. If it sticks there and freezes, it may collect to such a thickness that there remains only a groved path made by the rotating tire, just large enough for the tire to run in. If this occurs and you then try to make a sharp turn, your front wheels cannot turn and there is every chance that your car will leave the road. Proper steering care in winter weather means that you see to it that your fenders do not carry accumulated slush-ice.

4. Lights

Lights are comparatively easy to keep in an efficient condition. And yet many drivers fall down on this job, for in a majority of the cars tested at service stations, the lights are found to need attention.

A large proportion of serious accidents occur after dark and involve inadequate vision. At night, or in low illumination, you need every bit of assistance that is to be had from lights in perfect condition.

A simple and very common lighting trouble is DIRT!

Many drivers would be surprised to know that, by merely cleaning dirty lenses, the amount of light can often be increased by one-third.

On older model cars without "sealed-beam" headlights, tarnished or dull reflectors are very inefficient and should be carefully cleaned and polished several times a year. The dust or grit *inside* the headlights should be carefully wiped out. A soft, clean cloth should be used with light strokes to avoid scratching the reflector. Then the reflector should be carefully polished with lamp-black and alcohol.

Dim lights can be caused by any of the following:
- Dirt on lenses, reflectors, and bulbs
- Old or incorrect bulbs
- Bad reflectors
- Low voltage at the bulb socket, caused by a weak battery, corroded battery terminals, or defective connections

Sometimes a light burns out. If the bulb becomes blackened or cloudy on the inside, it should be replaced before it has a chance to burn out. For a burned-out headlight or tail light is dangerous. Everyone is annoyed by the danger of a "one-eyed" car. But, unless you check your lights now and then,

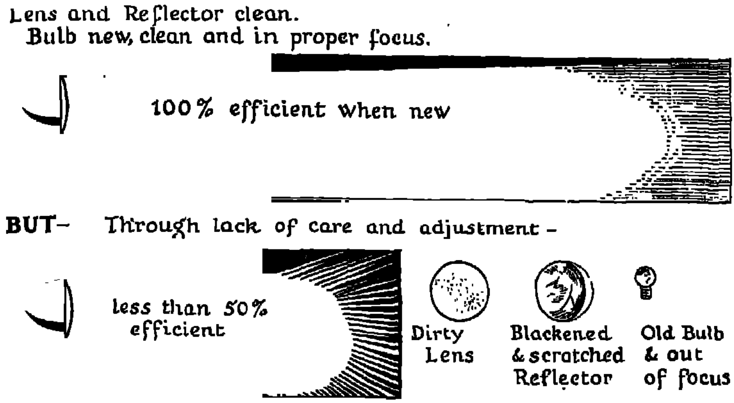

FIG. 281. Night driving requires the best that headlights can give you.

your car may be "one-eyed" without your knowing it. Extra light bulbs should be carried for emergency replacement on the road.

Practically all new cars, starting with 1940 models, have "sealed-beam" headlights. Bulb, reflector, and lens are a single sealed unit. This eliminates many of the problems common to older type headlights.

Suppose all of the lights suddenly go out. The wiring may need repair, or a fuse may be "blown," just as may happen in the lighting system in a home. Every car should carry

extra fuses, and the driver should know the location of the fuses and the technique of replacing one that is burned-out. Finding the fuses may prove to be something like a treasure hunt!

Open-road beams should not rise sharply in the air, but should be very strong at the proper height. Headlights should be tested for adjustment at least twice a year at a station prepared to do the job with modern equipment.

5. Other Safety Equipment

All the devices listed in Chapter XII as safety aids should be kept in good working condition.

Windshield wipers have to be kept in condition so that when needed they can be depended on to clean the glass well. A new blade is sometimes needed. Or the spring which holds the wiper against the glass may need to be tightened or replaced. Sometimes a drop of oil is needed at friction points. If the wiper is operated by suction produced at the "intake" manifold, the wiping may stop on a hard uphill pull because the suction is decreased. Removing the foot from the accelerator an instant will generally cause the wiper to start again. If the wiper cannot be made to operate fast enough or will not work at all, there is probably a leak in the air line or trouble in the little driving motor. In either case, repairing it is a job for the mechanic.

Horns, rear-view mirrors, and windshield defrosters should be kept in sound working condition all the time. Windshields and windows should be kept clean and unobstructed to provide the maximum visibility under all circumstances. To prevent frost or steam collecting on windshield or windows, open one window or ventilator slightly and use heater defroster attachment or a small circulating fan.

The driver of the automobile, can well afford to take a tip from aviation and railroading in checking the condition of equipment.

The motor of the airplane is gone over before every flight of any length. It is tuned up, oiled, greased, adjusted and put in a reliable condition. The landing gear and other parts are

also carefully inspected. Railroad companies, with years of experience behind them, regularly inspect equipment before and during each run.

Inspection of a car's safety equipment takes very little time when one does it systematically and has established it as a regular routine procedure.

KEEPING THE POWER PLANT EFFICIENT

Up to this point, we have been considering only the proper care of safety devices. Good automobile husbandry also means keeping the engine working efficiently. This practice decreases operating costs and increases your comfort and enjoyment in driving.

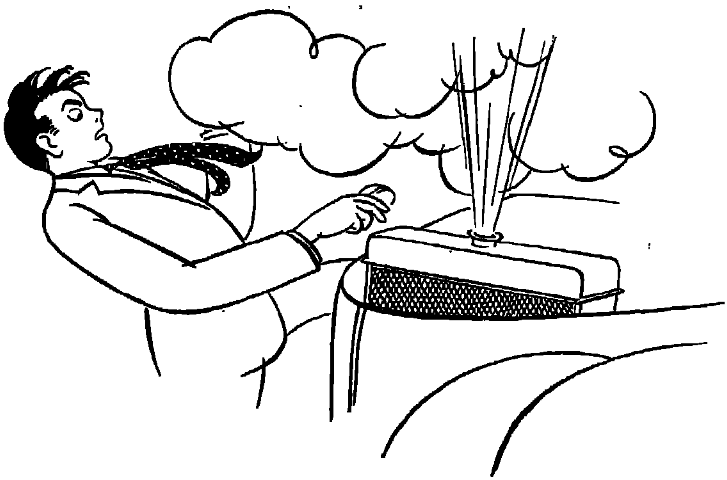

FIG. 232. Don't be foolish and remove the cap of a steaming radiator!

1. Care of the Cooling System

Overheating causes a great strain on delicately adjusted parts and takes life out of an engine.

Keep a well-adjusted fan belt. See that the radiator air passageways are not clogged with dirt, grease, bugs, or moths. Keep the radiator adequately supplied with clean water.

The water level in the radiator should be checked every few days and, on a long trip, every time you stop for gas. This is the first safeguard against the dangers of overheating.

Suppose that, in non-freezing weather, the pointer on the temperature gauge climbs up to the danger zone. What should be done?

1. Stop your car promptly in a safe location. Open the hood to see whether the fan belt is loose, off pulley, or broken.
2. If the fan belt is loose, adjust the generator position to increase the tension of the belt. If it is off the pulley, replace it. If it is broken, drive slowly, in high gear, to the nearest place for repair.
3. Check the amount of water in the radiator, being very careful not to be burned when removing the radiator cap. After the steam has subsided, look into the radiator, with the aid of a flashlight if necessary. If you cannot see the water, the radiator needs filling.
4. Let the engine cool off for a few minutes before adding any water, because of the danger of cracking the engine block or head. Start the motor only when ready to add water. Run the engine at an idling speed while filling the radiator. Then turn off the engine. With a screwdriver, tighten all hose connections, observing whether leaks have developed.
5. If, after driving a short distance, the water boils again, stop the car. Remove the radiator cap. See whether the water bubbles up and runs out of the radiator overflow pipe when the engine is accelerated. If it does, the radiator may be clogged or there may be some mechanical difficulty.

If the trouble persists after you make these checks, serious internal engine trouble may be the cause, and the car should not be driven farther than necessary to reach a reputable garage.

Freezing Weather Care

If steam appears around the radiator cap or overflow pipe during freezing weather, there may be insufficient cooling solu-

tion or the solution may be frozen in the small spaces in the radiator. If the radiator is frozen, the safest procedure is to get the car inside a warm place and let it thaw out. If it is not posible to tow it inside then test to see that the water pump is not frozen solid. In making this test turn the water pump by hand, by grasping the fan blades if attached to the pump, or the pump pulley if the fan blades are not attached. This test should be made before trying to start the engine, since starting with a frozen pump may cause considerable damage. If the pump (or both pumps on V-type engines) is not frozen, add sufficient cooling solution, preferably antifreeze, to nearly fill the radiator. The engine may then be run at a fast idling speed, with all openings to the radiator covered so the fan cannot draw air through them. Keep the solution at a visible level, and stop the engine for a few minutes if boiling recurs. To determine when the radiator is completely thawed, stop the engine and use your bare hand to find out if the entire surface of the radiator is warm. Pouring hot water over the radiator is another way to thaw it out.

If your radiator ever freezes, check for leaks that may have been caused by the freezing, and, if there are any, have them promptly repaired.

Of course, the proper procedure is to *use a good antifreeze solution before freezing weather comes.* Before you put in the antifreeze solution, be sure the cooling system is clean, leak-tight, and in proper working order. If it is dirty use an approved radiator cleaning compound following manufacturer's instructions.

Check all water hoses, including those to the heater, to be sure they are sound and have not collapsed. Replace them if there is any doubt of their soundness. If they are in good condition, make sure that the connections are tight and that there are no leaks, for good antifreeze materials are too expensive to waste.

Satisfactory antifreeze solutions are:

1. High Boiling Point type (sometimes called *Permanent*) —ethylene glycol sold under various trade names.

2. Low Boiling Point type (sometimes called *Semi-permanent*)—ethanol (ethyl alcohol) and methanol (methyl alcohol), commonly spoken of as "radiator alcohols" and sold in bulk and in containers under various trade names.

Most trade-marked antifreeze preparations contain rust inhibitors which help prevent rust forming in the system. Follow manufacturer's installation instructions. Do not use harmful antifreezes, such as those made from calcium chlorides or petroleum distillates.

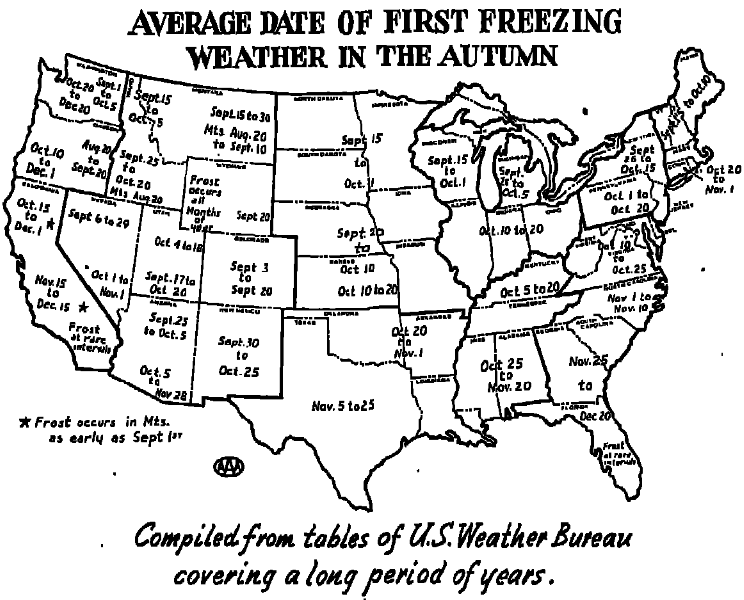

FIG. 288. Use of this chart may save money.

Be sure to use enough antifreeze material to protect your car against the lowest temperature likely to be encountered. Any good garage or filling station attendant will advise you on the amount necessary. If low boiling point antifreeze is used, the solution must be tested with an antifreeze tester or *hydrometer* now and then, for losses change the concentration of the solution and raise the freezing point.

After freezing weather is over, clean out the cooling system again, using clean, soft water with an approved rust preventive.

2. Proper Lubrication

Lubricate! Anyone who has had the sad and expensive experience of having to replace burned-out bearings, bushings, or other needlessly worn or damaged parts will emphatically warn you to *keep the car well lubricated.*

The manufacturer of your car has provided a lubrication chart. Follow it strictly to be sure that you are not inviting trouble by missing hidden parts that need lubrication.

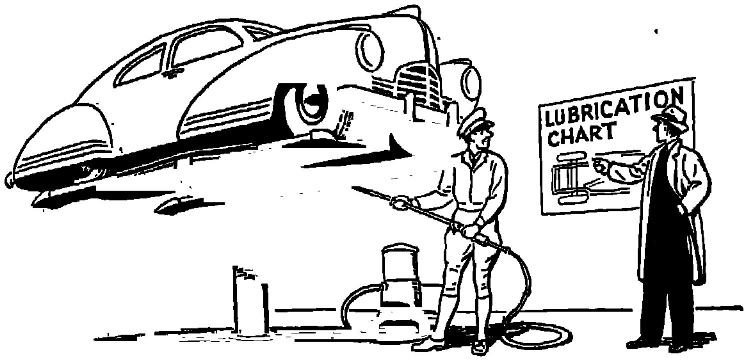

FIG. 234. Make sure your service man lubricates all important points.

Most drivers want to entrust the job of lubrication to a reputable mechanic. Unfortunately, some "oilers and greasers" are careless. So watch the lubrication job as it is being done. If your car was bought new from a reputable dealer, place the responsibility of lubricating it fully on his shoulders, being sure that you always take it only to him, and always on schedule. If his records then show that you have done your part, any trouble from faulty lubrication is his responsibility.

If you are going on a long trip, be sure that your car is properly lubricated just before you start—even if it means having it done a bit ahead of schedule. For long trips make special demands on lubrication.

Lubrication in Cold Weather

When cold weather comes, certain lubrication changes are needed.

Use lighter engine oil to make starting easier and to insure better lubrication. Use lighter, cold-test lubricants in the crankcase, transmission, overdrive unit, rear axle, and steering unit. Consult charts to determine the proper oils and greases for winter use in each part of your car.

A cold engine should never be raced. Take particular care in warming up a cold engine in the winter. Engines run more efficiently when they have been warmed to their proper operating temperatures. During a slow warming up, the oils become heated, and films of oil are supplied to moving engine parts before they can be injured by uneven heat expansion. Warm the engine slowly before starting out in winter.

When warm weather returns, be sure to change back to proper summer lubricants.

3. Care of the Ignition System

Ignition troubles occur now and then and can be very exasperating. For instance, there is the "won't start" situation. Avoid starting trouble by giving the ignition system a square deal.

Keep the battery in order. Keep battery plates covered with water. Cover connections at the battery with heavy grease to prevent corroding. If the battery shows signs of weakness in turning over the starting motor, or if the lights are dim and grow dimmer when the starter motor is in use, have the battery recharged or replaced. The voltage regulator may also be a cause of this trouble.

Depress the clutch when starting the engine, for this decreases the load on the starting motor and saves the battery.

Have distributor points cleaned and set periodically, and keep spark plugs in good condition. The spark plugs and distributor breaker points must be cleaned and properly "gapped" for good ignition performance.

Improper carburetor adjustments, or a small break in the

fuel line, sometimes make the engine behave in such a way that you may think you have ignition trouble.

A bad condenser or high tension coil can also cause trouble. They should be checked by a good mechanic when a skipping engine, uneven pulling on hills, or ignition trouble brings them under suspicion. Loose wires at plugs or coils are another cause of ignition trouble and can easily be checked.

If the battery is not strong enough to turn over the engine, it may be necessary to push the car to start it. Push the car while it is in high gear, with the clutch depressed and the ignition key turned on. When the car has considerable momentum, release the clutch gradually so that the moving car can turn the engine over. At the same time, depress the accelerator to give the engine sufficient gas.

If the engine is wet and will not start, turn the ignition switch off, and dry off the distributor, the end of the high tension coil, and the spark plugs with a clean, dry cloth.

For some cars it may be necessary to remove the distributor cap and dry out the inside, for water may have leaked in. If the engine is warm, just wait a while and its heat will usually dry the ignition system. During a severe rain storm, it is wise to drive slowly or, at times, even stop, to avoid stalling the engine.

The Ignition in Winter

Batteries need more care in winter. The battery undergoes a greater strain in winter weather, and, if poorly charged, is liable to freeze.

In winter it is especially important to depress the clutch when starting the engine. This action relieves the starting motor of the strain of turning gears in grease thickened by cold. If a new battery will soon be needed, get it as winter approaches. For it is a joy to have a strong, new battery when cold weather makes starting difficult and when lights are in use much more of the time.

On a car without an automatic voltage regulator the generator can well be set to a higher charging rate in winter, because of longer periods of after-dark driving, greater diffi-

culty in starting a cold engine, and the use of a heater and defroster.

Winter weather makes it more important than ever to keep the gaps of spark plugs and distributor breaker points properly cleaned and adjusted. Good strong sparks in cold combustion chambers certainly help a car make up its mind to venture out on a zero morning!

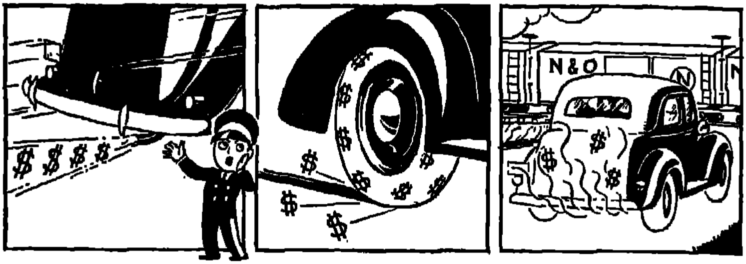

FIG. 285. Poor motor adjustments, sudden stopping, and useless idling waste motorists' dollars.

GETTING GOOD ECONOMY FROM YOUR CAR

Everyone wants to get as many miles per gallon of gasoline out of his car as he can. There are several common-sense practices which help improve gasoline mileage:

1. AVOID RACING YOUR ENGINE. Racing a cold engine burns as much gasoline as though you *were* speeding, and greatly increases motor wear.

2. AVOID EXCESSIVE CHOKING DURING THE WARM-UP PERIOD. Never leave a manual choke "button" out farther or longer than is necessary to get the engine running evenly. Leaving the choke pulled out causes excessive raw gasoline to be sucked into the cylinders.

3. START, DRIVE, AND STOP SMOOTHLY. Shift gears at recommended speeds. Driving too long in low or second gear wastes MUCH gas. Quick acceleration is also wasteful of gas, whether in starting or in driving along. Maintain a steady pace. The accelerator "pedal pumper" throws away gas. Plan ahead. When you have to make a screech-

stop, you have used gas unnecessarily. "Play the traffic signals" to "hit the green." Then you will not have to stop for a red light.

4. KEEP SPEED MODERATE. High speed requires much more gas per mile than moderate speed. An average of 50 miles per hour often requires at least twice as much gas as an average of 35 miles per hour.

Savings are not limited to gasoline alone. Studies made at Iowa State College indicate that tire wear at 52 miles per hour is 2.7 times as great as it is at 33 miles per hour. Moderation in driving speed also reduces oil consumption materially and increases the life of brake linings.

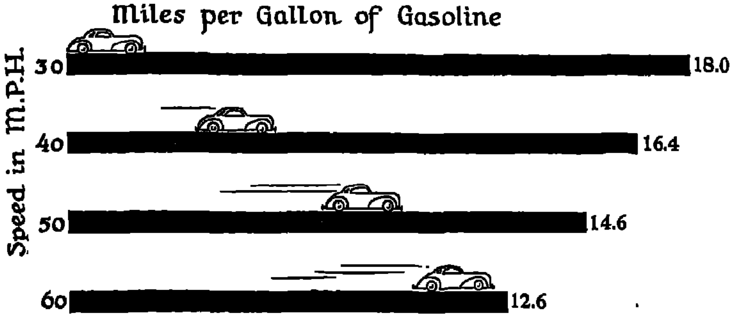

FIG. 286. Tests of gasoline consumption indicate sharp drops in miles per gallon with the higher speeds. Is the extra speed usually worth the additional gasoline?

5. SHUT OFF YOUR ENGINE WHENEVER YOU MUST WAIT SEVERAL MINUTES. Waiting for a slow freight train at a railroad grade crossing wastes gasoline. An idling motor, in some cars, uses a quart of gasoline in two ten-minute stops.

6. NEVER LET TIRE PRESSURE GET BELOW THAT RECOMMENDED. Learn what the pressure should be and check tires, including spare, once a week. Under-inflated tires make it harder for the engine to roll the car along. Driving on them wastes fuel.

7. KEEP CARBURETOR IN PROPER ORDER. Too

rich a mixture wastes gas. Keep air filter clean. Have carburetor and fuel pump cleaned and adjusted each 5000 miles.

8. MAINTAIN THE PROPER ENGINE TEMPERATURE. If the engine runs cold, have the thermostat repaired or replaced. When the engine is cold, more gasoline is used than when it is warm. If the engine runs hot, have a competent mechanic go over the cooling system. An overheated engine, too, wastes gasoline.

9. HAVE A HOT SPARK ALWAYS. You do not get the full power out of your gas with a weak spark. Fouled or improperly gapped plugs and worn distributor points are two common causes of a weak spark. Other causes are a weak battery, bad ignition coil, old or oily wiring, and loose connections.

10. KEEP IGNITION CORRECTLY TIMED. Have timing checked every 5000 miles. Incorrect timing means the spark occurs at the wrong moment, so the gas you use fails to produce its full power.

11. IN WINTER AVOID USING LUBRICANTS THAT ARE TOO HEAVY. The undue drag caused by heavy lubricants must be overcome by using extra fuel.

12. HAVE VALVES GROUND AND CARBON REMOVED. REPLACE WORN PISTON RINGS. Sticking valves reduce motor efficiency. Valves which are warped or do not seat properly, cause loss of compression and waste fuel. Excessive carbon causes "pinging" and loss of power and so wastes gas. Worn piston rings cause loss of compression and excessive oil consumption.

A car in good condition is something to which a driver can point with pride. In fact, the condition of the car definitely indicates the nature of driver. It shows him to be responsible or careless.

Whether or not your city or state has compulsory inspection of the safety equipment of motor vehicles, *it pays to keep your car in a sound condition on your own responsibility.*

A sportsmanlike driver knows his car, and he knows how to treat it. He gives it a square deal!

DISCUSSION TOPICS

1. Can you give evidence that most automobiles are operating much below their maximum efficiency?
2. Discuss what is meant by keeping a car "tuned up."
3. From the point of view of economy, discuss the value of keeping proper pressure in the tires. Give as many reasons as possible why economy results.
4. Would it be fair or unfair to enact legislation prohibiting further use after cars have been used a certain number of years? Why? After a certain mileage? Why?
5. How can you check the stop-light while you are in the car?
6. Debate: It is more serious to have the steering system of the car go wrong than any other part of the car.
7. Discuss the proposition that a car may function just as inefficiently because non-engine parts are in bad order as because engine parts are defective.

PROJECTS

1. Witness an inspection at a garage or official inspection station and learn what devices and instruments there are for accurate measurement of a car's condition and efficiency. Report your observations.
2. Some good drivers do not believe it necessary to change engine oil as frequently as the lubrication chart recommends, provided their cars have good oil filters. Check up carefully on this matter and discuss your conclusions with your group.
3. Make a list of practical ways of preserving the value of your investment in a car. Would you include keeping the car polished and out of the sun as much as possible? Why?
4. Try the experiment of driving for an hour or two with as little use of the brake as possible. How many times did you *have* to use the brakes? Why is it true that brakes need not often be used in well-controlled cars?
5. Obtain an old inner tube, or even a section, if a whole one is not available. Borrow two tube patching kits, one for applying cold patches and one for applying hot patches. Learn from your instructor or a local service station attendant how to use both, and demonstrate the processes to your class.
6. Inflate the tires of the family car to the recommended pressure and measure the pressure in each tire with an accurate gauge. Screw the valve caps on tight to prevent any loss of air. One week later check the pressures again. Any tire which is more than 3 pounds below the lowest of its running mates may be suspected of having a leak.

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PART IV • The Motor Age Advances

CHAPTER XX

Improving the Automobile

Do You Know:

What early automobiles were like?
What changes have taken place in the automobile?
The story of the development of motor fuel?

THE STORY OF THE MOTOR CAR

ALTHOUGH we live in an Automobile Age, our grandfathers did not. In 1895, there were four gasoline automobiles in the United States. People were shocked because these cars could be driven at "the ungodly speed of eleven miles an hour!"

Today there are approximately 31,035,500 motor vehicles in the United States, and they have attained speeds undreamed of by our grandparents. In 1935, Sir Malcolm Campbell reached his goal of 300 miles an hour! On August 23, 1939, John Cobb, another Englishman, broke a former record of 357.5 m.p.h. by the unprecedented speed of 368.9 m.p.h. The automobile has had a phenomenal development in 50 years.

A motorist in the early days of the automobile needed ingenuity, strength, and a sense of humor. Tire blowouts, broken springs, and engine trouble were common. "Get Out and Get Under" was the title of a popular song in 1913.

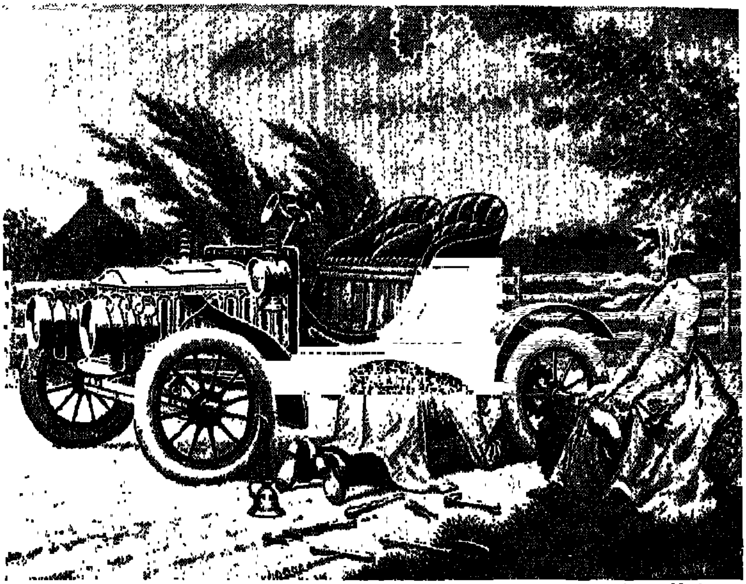
Today the picture is different. Automobiles are powerful and quiet. They ride smoothly and are so dependable that the driver need not be a mechanic. Automotive engineers have made motoring comfortable, swift, and reasonably economical.

The history of the coming of the automobile is a fascinating one, but only the highlights can be given here.

No one person invented the automobile.

Charles F. Kettering, a leading automotive engineer who was himself responsible for numerous automotive inventions and improvements, once said, "The motor car is not the invention of any one man—but a composite of many inventions. Al-

though scarcely more than a generation old, the true beginning of the automobile antedates all recorded history." This is indeed a true statement, for the automobile utilizes simple mechanical inventions like the wheel and the lever, and no one knows by whom or how long ago they were invented.



Courtesy Edison Institute, Dearborn, Michigan.

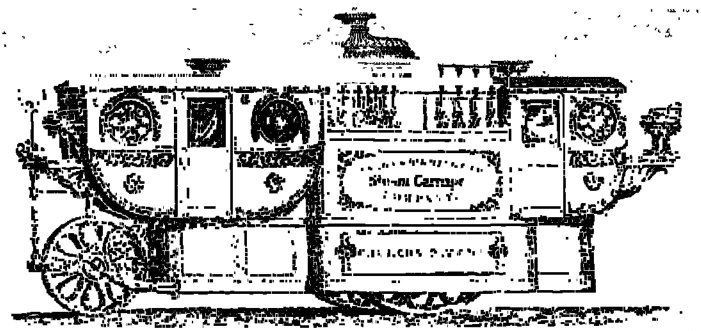
FIG. 287. When "Get out and get under" was a fact as well as the title of a popular song.

The first practical steam engine was invented around 1700 by Thomas Newcomen. It did not use the pressure of condensed steam. Steam flowed into the cylinder from the boiler at atmospheric pressure. A jet of cold water was introduced into the cylinder at just the right time. This condensed the steam and produced a vacuum. The air pressure then forced the piston down.

In 1765, James Watt invented a separate cylinder to condense the steam, and by 1776 he had constructed an engine with lower coal consumption and greater commercial value. These

so-called "atmospheric" or vacuum engines, with large cylinders and boilers, ponderous overhead walking beams slowly seesawing up and down, but no method of obtaining rotary motion other than by use of a waterwheel, were the only source of machine-made power for nearly a hundred years.

Richard Trevithick actually produced the first practical high-pressure steam engine. His engines were used, from 1799, to hoist tin ore from Cornish mines. People called his engines "the puffers." Trevithick realized that he had a source of portable power. On Christmas Eve in 1801, near his native town of Camborne, England, he tested the first self-propelled vehicle to transport passengers on a road. After this, the use of the high-pressure steam engine rapidly spread and led to the famous steam coaches of the 1820's and 1830's.



Courtesy National Museum, Washington, D. C.

FIG. 288. Riding in Style—Steam cars successfully operated in England about 1830.

The first attempt to operate a piston in a cylinder used small charges of gunpowder. This was the forerunner of the internal combustion engine. The first internal combustion engine to have practical success was made in 1860 in France by Etienne Lenoir using illuminating gas as a fuel. Lenoir's engine, however, did not compress the gas-air mixture before firing. In 1876, Dr. Nicholas A. Otto, a German, designed the first four-stroke cycle engine, using compressed gases before firing, just as is done today.

By 1885, Gottlieb Daimler, a former associate of Otto's, had developed a vertical, high-speed, single-cylinder engine. This engine was fitted into an ordinary four-wheel carriage in 1886. By 1889, Daimler had a V-shaped, high-speed, two-cylinder engine, destined to be the internal combustion engine that started an intense rivalry with the then highly developed steam engine that was drawing vehicles at speeds up to 25 miles per hour.

Daimler's car was further developed by Panhard and Levassor of France. By 1891, the new Panhard car had a sturdy frame, the engine mounted upright under the hood in front, a clutch, a differential gear, and driving axles connected to the rear wheels by chains on sprocket wheels—fundamentally the same elements used today, except that chains have now been replaced by a propeller or drive shaft with universal joints to drive the differential.

American Automobile Pioneers

The first successfully operated, American-built motor car was constructed by Charles and Frank Duryea in Springfield, Massachusetts, in 1893. Its design was taken directly from the buggies of those days, and the vehicle was described as a "horseless buggy." It is still preserved in the Smithsonian Institution in Washington. The Duryeas won the first road automobile race ever held in the United States on Thanksgiving Day, 1895. Despite the handicap of slush and snow, a Duryea covered the 54-mile course in 7½ hours, or at a rate slightly over 7 miles per hour!

The Duryea car was followed by one designed by Elwood G. Haynes and built by the Apperson Brothers in 1894. Henry Ford built his first car in 1896. R. E. Olds built one in 1897. By 1900, there were 4,192 automotive vehicles in use in the United States. Most of these were steam and electric vehicles.

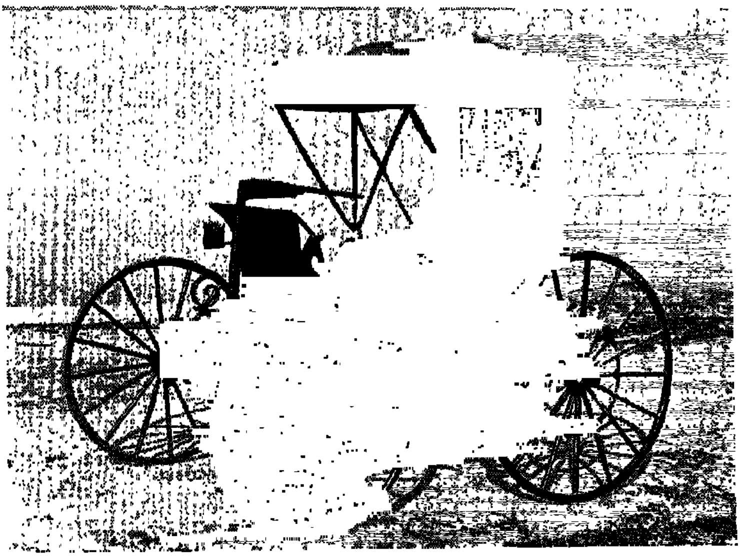
Up to 1900, cars were the products of tiny machine shops and backyard sheds. They were individually assembled from such parts as came to hand or could be roughly fashioned by inventive mechanics. The next step was to manufacture motorcars in quantity and at a price low enough to assure their sale

in volume. Although the automobile was a European development, mass production of cars was an American contribution.

The pioneer in mass production was R. E. Olds, who organized his company in 1899. The famous curved dash "Olds Runabout" had a one-cylinder engine, weighed 700 pounds, and sold for $650. In 1904 the company produced 5,000 cars.

Other companies that started in those early years and are still making cars include the Packard in 1900, the Cadillac in 1902, the Ford in 1903, the Buick and Studebaker in 1904, the Oakland (now Pontiac) in 1907, and the Hudson in 1909. In 1908, Henry Ford brought out the famous Model T, destined to number millions.

Production of motor cars in quantity depended, among other things, on the use of standardized parts. All carburetors, hub caps, or other parts for a car of a given model had to be made identical and interchangeable. This made it easier to assemble a car and also to replace any lost or worn parts.



Courtesy National Museum, Washington, D. C.

FIG. 289. America's "first" automobile, built by Charles E. Duryea.

To speed up mass production, automobile factories soon introduced a wholly new manufacturing procedure—the conveyor system, or the so-called "assembly line." This kind of production depends upon a continuously moving conveyor which carries the developing car past groups of workmen. Each specially trained group adds a part or does *one* job, until finally, at the end of the production line, another new car rolls off. Not only are the cars assembled on an assembly line, but various parts, like the engine block, pass from one machine operation to another on a production line towards the engine assembly line. There they are assembled with the other similarly made parts and then conveyed to the final assembly line. Completely assembled, the engine arrives at the proper location to be placed in the car. Such "mass production" methods have boosted production and greatly lowered costs.

FROM HORSELESS BUGGIES TO STREAMLINED CARS

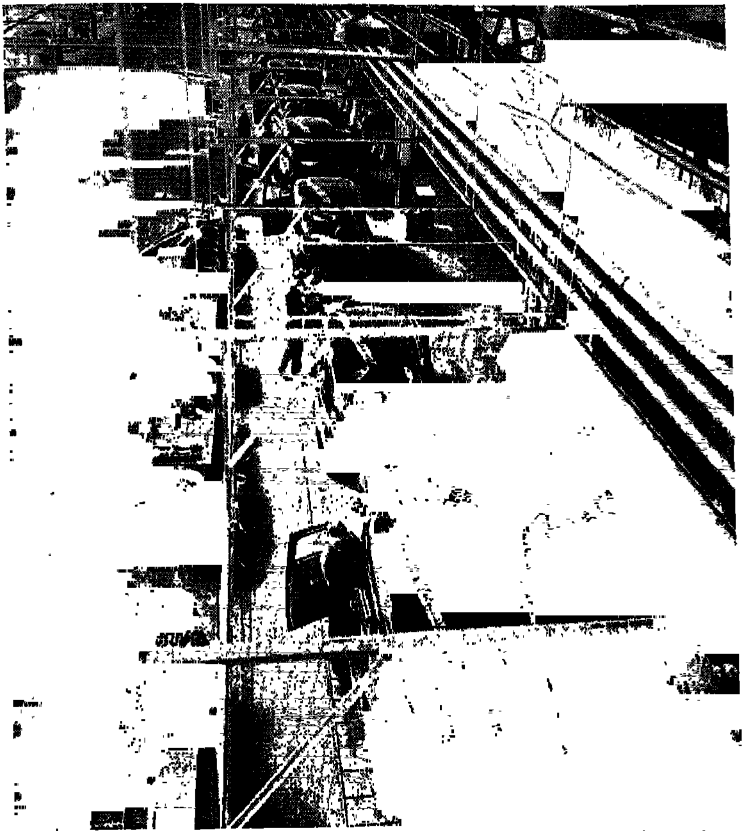
Many major improvements in cars have added to their safety, performance, economy, and comfort. Some of these improvements are indeed spectacular.

Closed Bodies—The first closed-body car appeared about 1910. It was poorly adapted to general use. Squeaks developed rapidly, and its construction was so flimsy that it was no match for the rough roads of those days. For many years, in fact, the closed car was regarded as a luxury vehicle for occasional use on city pavements. But engineers have so improved closed-body design and construction, and highways have been so vastly improved, that open models are the exceptional ones today. The closed body permits greater comfort and safety for year-round private use, and it makes motor transportation adaptable to far wider commercial use.

Self-Starter—The early cars had to be cranked by hand. And what broken arms and doctors' bills that practice caused! In 1911, Cadillac installed an electric starting device which was invented by engineer Charles F. Kettering. The starting device used today utilizes the Bendix drive, invented by Vincent Bendix. The starter was a very significant development. It

removed a serious hazard from motoring and was an important step in adapting the automobile to use by women.

Improved Transmission—Not many years ago one frequently heard loud grating and grinding noises as drivers shifted gears. Today, because of vastly better transmission systems, the average driver can swiftly shift gears at varying car speeds without clashing or grinding. Improved transmissions constitute a valuable *safety factor* on hills and slippery



Courtesy General Motors Corporation.

Fig. 240. Nearly completed automobiles nearing the end of the production line in a modern automobile factory.

pavements, or whenever traffic situations demand a rapid change of gears.

Multi-cylinder Engines—The first American automobiles were "one-lung" cars. In time, four-cylinder engines became common. Today six- and eight-cylinder engines predominate. A few makers provide luxury power plants of twelve and even sixteen cylinders.

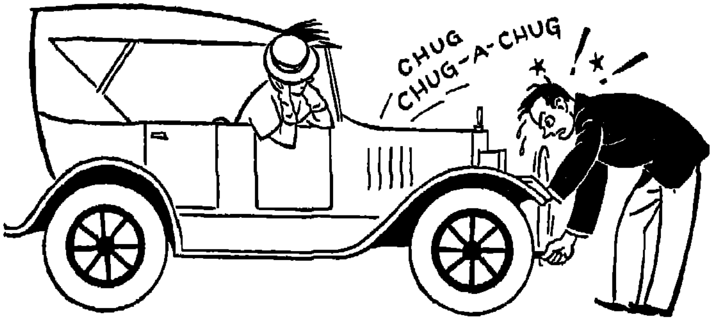


FIG. 241. Lost tempers and broken arms often resulted before the self-starter was invented.

Four-wheel Brakes—Today's higher speeds of travel and more complex traffic conditions require the best that brakes can give us. The most impressive brake developments have been the addition of brakes on the front wheels and the use of hydraulic brakes to give uniform braking on all wheels.

First introduced on the Buick 1924 models, four-wheel brakes are now standard equipment on all passenger cars. Four-wheel brakes have materially reduced the "danger zone" at any given speed. Better brake linings and drums, more equal braking on wheels, and other improvements have tended to keep braking efficiency apace with increased driving speeds.

Better Tires—Fortunately for the motorist, improvement in tires has been steady. Improved cushioning quality in pneumatic tires lessens the jar from rough, uneven roads. Formerly, passenger car tires carried from 50 to 100 pounds of pressure. The change from high pressure to low-pressure balloons with a larger cross section, using air pressures of ap-

proximately 32 pounds per square inch, has resulted in improved riding comfort.

Thirty-five years ago, a 30 x 3½ tire for a small-sized car cost $25.85, and the user was considered lucky if it ran thirty-five hundred miles. Today a tire in the same class (6.00 x 16) costs about $16.00, and if it does not run twenty to thirty thousand miles, its owner may have cause for a just complaint.

Tires have become so dependable and the "spare" is so common that most motorists no longer carry a tire repair kit or pump, which was part of the standard equipment of a few years ago. Combined with many improvements which give greater strength and durability, other new features help prevent blowouts, and improved tread designs provide a maximum of traction on wet pavements.

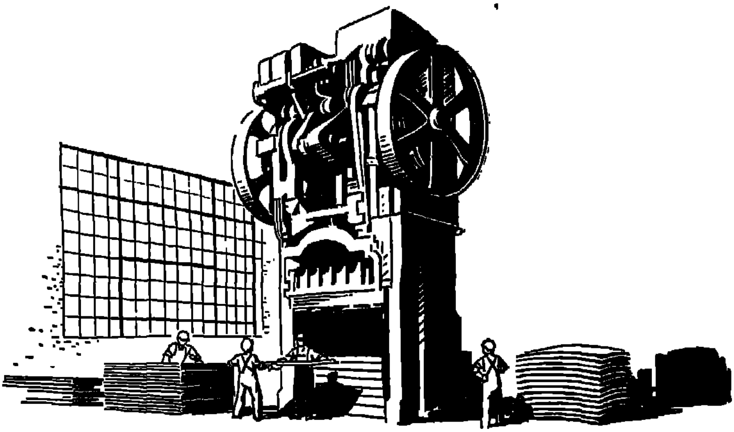


FIG. 242. Giant presses now ingeniously stamp out tops and other parts for all-steel bodies.

All-Steel Body Construction—The advantages of covering automobile tops with solid steel have long been recognized, but certain difficulties, such as the building of large and powerful presses, stood in the way. Now, under the new construction methods, a dome-shaped lid is pressed into desired form by giant machines and is electrically welded into place. A steel floor is then welded to the bottom edge of the body. The steel

top is strengthened by rugged steel "beams." This makes a rigid, "one-piece" unit, shaped and reinforced to provide maximum strength, durability and protection.

Lower Center of Gravity—In recent years, the tendency has been to lower the center of gravity of cars by using smaller

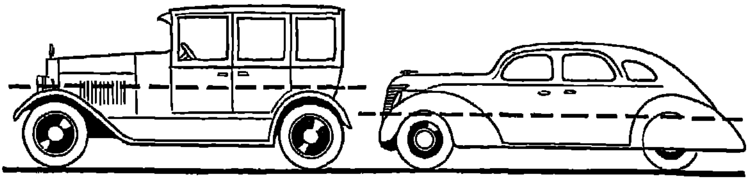


FIG. 248. Modern cars do not turn over so readily because of a lower center of gravity. Dotted lines represent heights of center of gravity.

wheels and by lowering engines, floors, gasoline tanks, and all driving units. This has greatly reduced the danger of turning over.

Streamlining—Researches leading to "streamlining" airplanes probably speeded up the streamlining of cars. We now have simplified contours and a minimum of protruding parts. Other streamlining features are the airplane-type, V-shaped windshield, modified fenders and wheel casings, enclosed spare wheel, the "tailed out" rear end to reduce air drag, and concealed running boards.

Streamlining is relatively unimportant for speeds below 50 miles per hour. Its importance increases very rapidly as speeds rise above 50. For air resistance increases about as the cube of the speed. At 63 miles per hour, about twice as much engine power is required to push the car through the air as at 50. At 72 miles per hour, about three times as much engine power is needed as at 50. This makes streamlining a very significant feature in any kind of high speed transportation.

Other Improvements—Numerous other features of modern cars have increased the comfort and safety of driving —

Improvements in steering systems
Non-shatterable glass

Sealed beam headlights, with open-road and passing-beam patterns
Wider windshields, slanted to reduce glare
Narrower frame supports to increase visibility
Larger rear windows
Readily adjustable seats
Better ventilation
More easily read speedometers
Sway stabilizers
Fluid clutch
Automatic gear-shifting
Improved trunk capacity
Built-in windshield defrosters
Better all-around design to improve riding and roadability

Of course there is still room for improvements in car design and construction, and interesting research will go on to improve still further the motor car of the future.

Trucks and Buses—With increased use of trucks and buses there has also come great improvement in their design and construction. Multi-cylinder engines, more powerful brakes, easier steering, better riding qualities, and improved lighting and signaling apparatus are only a few improvements.

The modern truck or bus runs on large pneumatic tires designed to avoid excessive impacts on pavements even when the vehicle is loaded to capacity and operating at considerable speed. Special chassis have been developed for specific truck uses. There are light units for quick city delivery, mammoth vans for long-distance hauling, dump trucks, glass-lined tank trucks for carrying milk, "ready-mix" trucks that haul wet concrete and mix it enroute, and even palatial cars for transporting race horses.

Modern buses are also designed for special purposes and capacities.

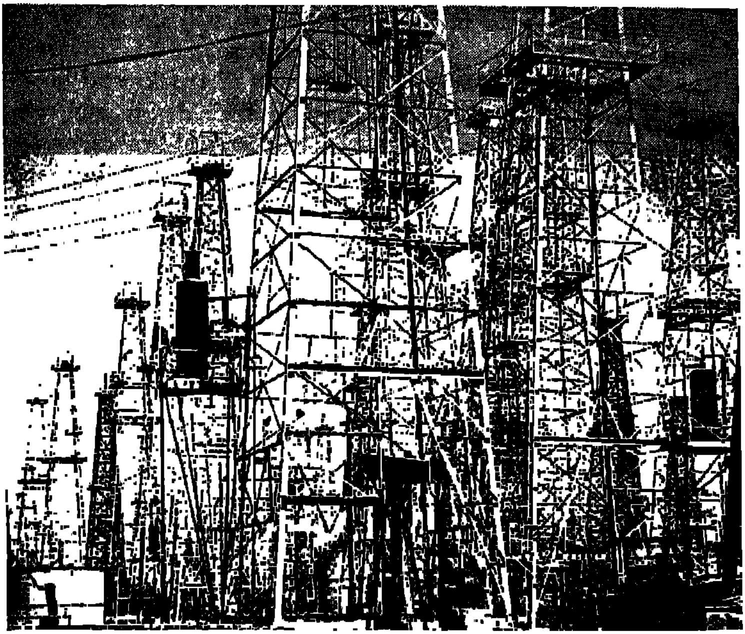
HOW "DRAKE'S FOLLY" BECAME "DRAKE'S DREAM"

The story of improving the fuel for the car is as interesting as the story of the development of the car itself.

In 1859, Colonel E. L. Drake drilled the first oil well at Titusville, a little lumber town in northwestern Pennsylvania. Seeping oil from underground sources in this section had been known from the very early Colonial days. But to drill a well for oil was such a novel idea that those lacking in imagination referred to the enterprise as "Drake's Folly."

Despite their scoffing, Drake's helpers, "Uncle Billy" Smith and his son, Sam, went to work with makeshift drilling machinery, and on August 27, 1859, they discovered that their 70-foot well contained oil. Few discoveries have had a more profound effect upon society.

With his 70-foot well, Drake probably never dreamed that subsequent developments would make possible the drilling of wells to a depth exceeding 17,000 feet. Nor could he for a



Courtesy Petroleum Conservation Division, U. S. Department of Interior.

FIG. 244. Crude oil production—This mammoth industry provides enormous quantities of gasoline for motor vehicles.

moment have foreseen that the time would come when more than 5,000,000 barrels of crude oil would be produced daily in the United States.

In Drake's time, petroleum or "crude oil" was considered valuable primarily for medicinal purposes. The coming of the automobile provided a new use for the petroleum product known as *gasoline*. Lubricating oil for automobile engines, and the fuel oil now widely used for heating homes, are also important products of petroleum. Innumerable other by-products of petroleum are also exceedingly valuable.

Because of the increasing demand, chemists developed the "cracking" method of refining oil, a method which has doubled the gasoline output per barrel of crude oil. In recent years, catalytic cracking has changed the entire picture of petroleum processing. Chemists have also improved motor fuels by the addition of chemicals which reduce engine knocking.

As is true of our other national resources, the record of petroleum production is one of reckless exploitation and tremendous waste. Billions of cubic feet of natural gas have been allowed to escape into the air. More oil has been produced than was needed, partly because of the nature of the industry itself. For example, a "pool" of oil may underlie land owned by different people. If one of these property owners drills a well, the others must also drill. Otherwise the first well drains all the oil from the pool, and the other property owners get nothing. Whenever oil was discovered in a new place, each owner rushed to take out as much oil as possible before competing wells in other areas were brought in. This peculiar nature of the industry led to an excessive supply of crude oil and gasoline in storage above ground.

As a result of such conditions, the government has been forced to step in to restore order and to determine policies that will be for the best interests of the industry and the country alike. For we should conserve petroleum, so vitally useful in times of peace as well as in times of war.

Methods of transporting petroleum have kept pace with the growth of the industry. Crude oil was first shipped in barrels.

Then tank cars and tank vessels took the place of the single barrel unit. A later means of transporting oil was the pipe line. The first one, built in 1865, covered a distance of 5¼ miles. Contrast this with the lines built to connect the Oklahoma field with the Atlantic seaboard, more than 1,500 miles distant.

At present, gasoline is the principal motor car fuel, though a much less expensive, diesel oil product is increasingly used on large trucks and on railroad locomotives. The exhaustion of our oil supply would force the development and production of new kinds of fuel and probably new types of motors.

The synthesis of petroleum hydrocarbons is in its infancy. The ultimate development of this new frontier of science is a challenge to the thinking of every petroleum technologist. This much we know—motor fuels and lubricants can be "tailored" to fit the engine in which they perform. Within a decade, miracles of motor efficiency are bound to result.

Who knows what further development of the application of atomic power may mean to future transportation?

DISCUSSION TOPICS

1. What are the major advantages of the conveyor system or assembly line?
2. Discuss the development in the general appearance and design of automobiles. Note the progress away from the carriage type.
3. Why are such features as smoothness, quietness of operation, comfort, and convenience important to safety of operation? How can they interfere with safe operation?
4. There are producing oil wells in nineteen states. Can you name these states? Discuss the importance of petroleum in the economic life of these sections.
5. We need men with qualities such as Drake had. Why? What qualities did he possess which the average person lacks? In what fields are persons of this sort most needed today?
6. Discuss the relative importance to the car owner of dependability, economy, comfort, safety, attractiveness, power, and length of car life.

PROJECTS

1. Compare, point by point, an early model with a present-day automobile, to bring out the advances in automobile design. Arrange the items in parallel columns.

2. Make a picture scrapbook of (a) the various makes and models of passenger cars and (b) the various types of commercial vehicles.
3. Petroleum is refined by a process known as fractional distillation. Look this up and report on it. What is meant by "cracking" oil?
4. Find out more about "streamlining" and its relative importance at various speeds. What would the front of a car look like if the streamlining idea were fully applied?
5. Prepare a list of features of the modern car which you think warrant further improvement for safety. Place the items in order of importance, as you see them. Discuss the subject with some safety engineer.

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CHAPTER XXI

Highways for the Motor Age

Do You Know:

How important modern roads are in American life?
What are the features of the best roads of today?
What problems face the highway engineer?
What we may expect in the highways of the future?

MODERN ROADS ARE INDISPENSABLE

MODERN roads are indispensable to the motorized civilization we have developed. Highways are used for many purposes:

1. Business, recreation, and personal calls
2. Movement of produce and other merchandise
3. Delivery and pickup of mail
4. Protective services by physicians, ambulances, the police, and the fire department
5. Military and governmental activities

Differences in usage require different kinds of roads. There are wide differences in volumes of traffic and in the wear and tear caused by various types of vehicles. A relatively small percentage of our roads are main arteries connecting cities, states, and regions. Most of our roads serve local purposes.

ROADS CHANGE WITH NEEDS

Roads must be widened, straightened, paved, and improved in various ways. As funds permit, road engineers will build new roads and rebuild worn-out old ones so that they will *meet the changed needs of our time.*

In the early pioneer days, road needs were simple. Paths started by deer, buffalo, and other animals were often followed by Indians and later by our forefathers. These paths, as they were gradually worn and widened, became the routes over which the early settlers drove live stock, ox carts, and covered wagons. These crude roads generally followed along *high* land where mud and mire were less likely to interfere with travel. So they were truly *highways.*

Colonists soon wanted better roads for wagons, stage coaches, and growing traffic. Our military forces needed better roads to move troops, supplies, and artillery. Such changing needs were responsible for numerous routes which later became major highways. Gradually, more and more roads were built wide enough to permit vehicles going in opposite directions to pass without pulling off the road. Many of the lesser "ups and downs" were levelled out. Roads were made higher in the

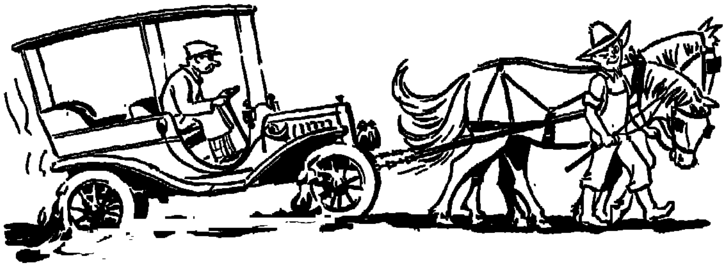


FIG. 245. Early motorists frequently were forced to use this method to get out of a mud-hole!

middle than at the sides for better drainage, and ditches were dug along the roadside so that rain water would not stand on the road surface.

Up to the coming of the automobile, travel distances were generally very limited. With the automobile came demands for roads suitable for long trips. Out of these demands grew the first state highway departments and the creation by the Federal Government of an organization now known as the United States Public Roads Administration.

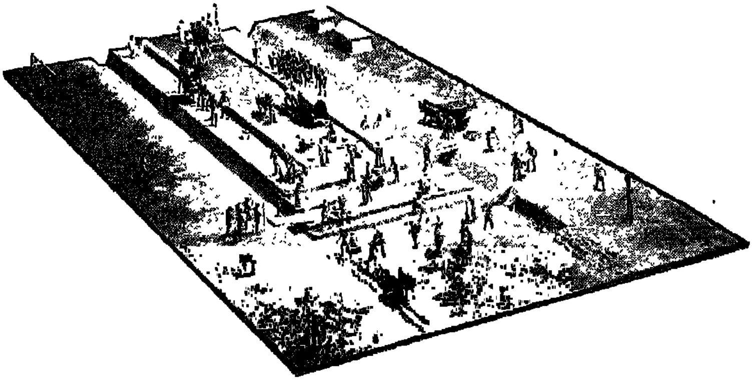
Trace developments during the Automobile Era, and you are impressed with the rapid evolution of major roads to meet our changing needs.

BUILDING BETTER ROADS

Fortunately, man has long known how to build roads that remain hard and reasonably smooth even in bad weather.

The early Romans needed durable highways to link their extensive conquered territories, so that their vast military forces

could be moved without delay. They built many sturdy roads with a foundation of great blocks of stone closely fitted together. Their major roads were so well built that many of them have weathered the centuries. Some, after reconditioning, are used today.



Courtesy U. S. Public Roads Administration.

FIG. 246. Two thousand years ago the Romans built roads suited to their needs. This model showing the method of construction of the Appian Way was made by the United States Public Roads Administration, and is on display in the National Museum, Washington, D. C.

Foundations

Early in the nineteenth century, the Telford and the McAdam principles of building a solid foundation and a hard, water-tight surface were developed. Today, these principles, as well as more modern methods of making sound road foundations, are used in all road construction of the better sort.

In building a road over a new route, tree stumps, roots, large rocks, and vegetation are first removed, at considerable cost in time, hard work, and money. Hillocks and high spots are removed and the dirt used to fill in low places. Side ditches are dug, and the dirt is used to crown the road so that it will shed water.

Surfaces

On some improved roads, gravel, or a proper mixture of sand and clay, is used for surfacing. Sometimes the surface is made

up of layers of crushed stone with smaller stones, chips, or screenings placed on top and rolled. Water is then sprinkled on the surface to wash the small stones and chips into the holes or spaces between the larger stones. Asphalt, or some other binder, is used more and more to help hold the surface together. Heavily used roads are usually paved with a hard, smooth layer which will bear heavy loads, keep out water, and wear well. There are several different types of paving, such as bituminous macadam, sheet asphalt, brick, stone block, and concrete.

Engineers have developed road surfaces on which tires are much less likely to skid than on some of the older road surfaces. Some old "black top" surfaces are very slippery when wet.

Wider Pavements

About 1915, a pavement with two eight-foot lanes was considered adequate. But increased speeds and wider vehicles have made it necessary to increase lane widths. Now twelve-foot lanes are recommended for important roads, with even greater widths on curves.

On busy highways, traffic volumes grew until passing with only one lane in each direction was difficult and dangerous. So in some places a third lane was added, the middle lane, to be used exclusively for passing. But, with traffic heavy in both directions, there is too much competition for that middle lane. This hazard proves so great where hillcrests, curves, and "dips" prevent seeing far enough ahead to pass with safety that the three-lane highway is regarded by most traffic specialists as an unsound design. More and more four-lane highways are being built where two lanes are inadequate.

Longer Sight Distances

The faster you drive, the farther ahead you must see to overtake and pass safely. Modern speeds make it dangerous to try to pass when hillcrests, curves, and "dips" may hide oncoming cars.

"Blind corners" are also places of special danger, because you cannot see cross-road vehicles soon enough.

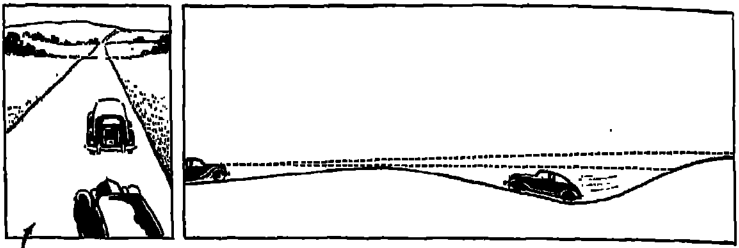


FIG. 247. Modern highway engineering eliminates the dangerous "dips" found in older types of highways.

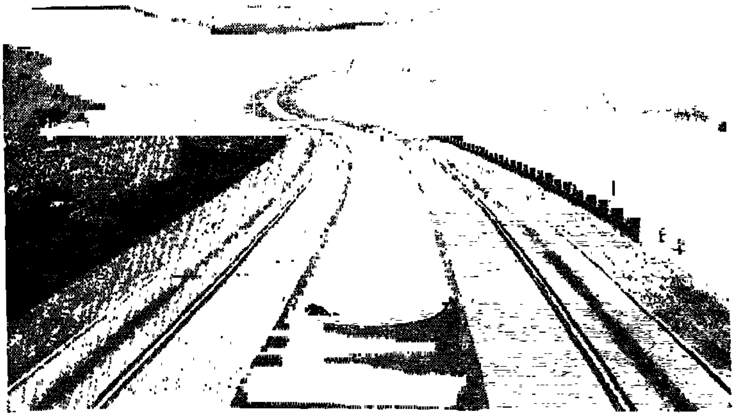
Road construction now emphasizes increased sight distances. According to the American Association of State Highway Officials, the minimum sight distance for passing should be 1600 feet for a speed of 50 miles per hour, and 2300 feet for 60 m.p.h. Even where passing is not permitted, you need long sight distances for safe stopping within your own lane, after seeing any obstacle blocking it.

Flatter Cross-Sections

Old paved roads were considerably higher in the middle than at their edges. Modern roads have much less crown and are considerably safer, especially on curves, many of which are banked slightly today, or, as engineers say, "super-elevated."

Divided Highways

A center-strip, separating the highway into two one-way drives, helps reduce some of the most serious types of accidents, such as head-on collisions, sideswipes, cutting-in crashes, and crashes caused by headlight glare. Studies made of accidents and the reactions of drivers indicate that separator strips are very valuable.

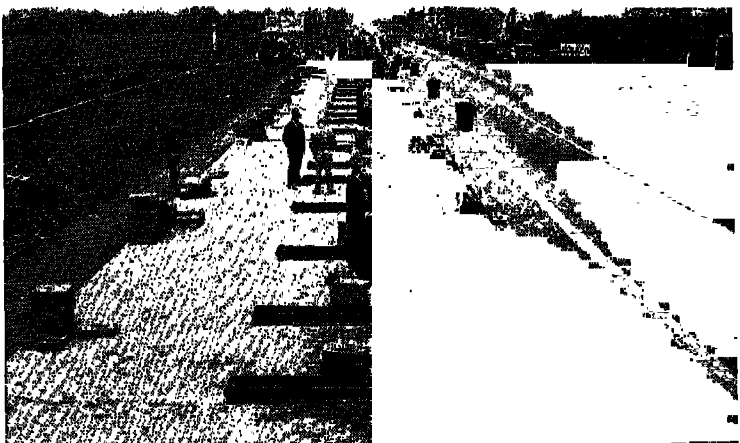


Courtesy U. S. Public Roads Administration.

FIG. 248. Motoring is a pleasure on highways like this!

To permit overtaking and passing, divided highways must have at least two lanes on each side of the center-strip.

An increasing number of future highways carrying heavy traffic will be constructed with such separator strips.



Courtesy Compressed Air Magazine.

FIG. 249. Air pressure was used to push half of this road pavement to one side to provide a separator strip on a major New Jersey highway.

Other Road Improvements

A list of other modern road improvements would include:

- Elimination of culvert headwalls near the paved surface
- Replacement of narrow bridges with wider ones
- Elimination of deep side ditches
- Wider and firmer shoulders
- Gentle side slopes making guard rails unnecessary
- Better guard rails where gentle side slopes would be impractical
- Physical improvements at intersections to reduce delays and crashes
- Continuation of road "shoulders" under overhead bridges to reduce danger of striking bridge supports

IMPROVEMENT OF INTERSECTIONS

In cities, approximately one-half of the fatal accidents and nearly three-fifths of non-fatal accidents occur at intersections. Even on rural roads, a large proportion of accidents occur at road crossings. When traffic is heavy on roads that cross each other, less than half as much traffic can flow without interruption than at crossings where one road is carried over the other.

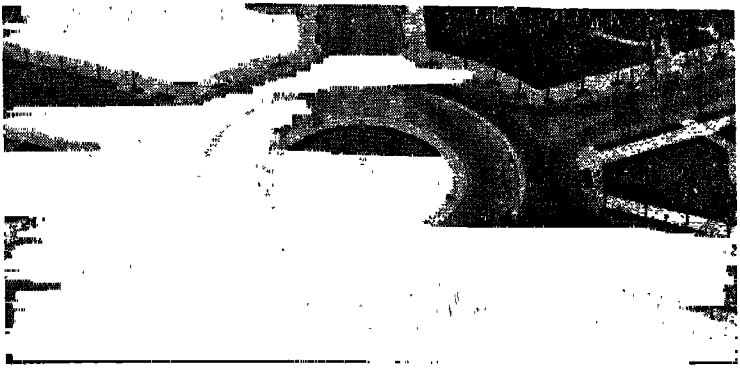
Where traffic is heavy, improvements such as the following can be developed or installed at intersections:

1. Traffic control devices, such as traffic signals and stop signs
2. More sweeping curb lines to make turns easier
3. Longer sight distances
4. Isles of refuge for pedestrians, and channelizing islands to separate vehicles
5. A special lane for right-turning traffic
6. Wide approaches for some distance back, so that—
   - Drivers can get into proper lane position for turns
   - Waiting cars need not line up so far behind the intersection, and so can pass through in less time
   - Cars can enter and leave intersections two or more abreast

There are two more expensive types of intersection design which are very important in modern highway engineering—the *traffic circle* and the *grade separation.*

Traffic Circles

Traffic circles are intersections where all vehicles move in a counter-clockwise direction around a central island. See Fig.



Courtesy Army Air Forces.

FIG. 250. Note from darkened "paths" how traffic converges and assorts itself around this circle.

250. Drivers "weave" their way in or out between other vehicles until they turn right to leave on the desired road.

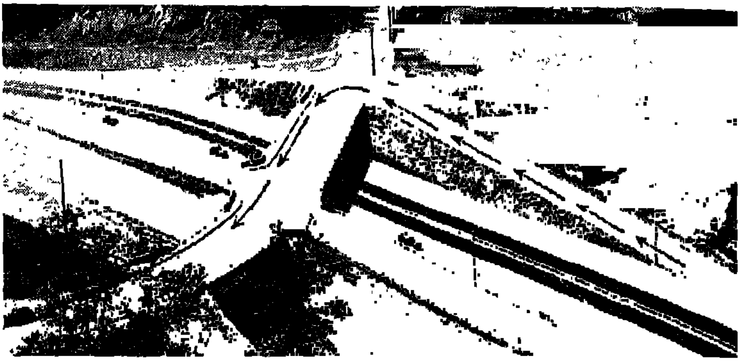
A well-designed traffic circle, or rotary, eliminates, or greatly decreases, the need of stopping and waiting. "Steady flow" replaces stop-and-go operation. Properly designed traffic circles compel drivers to slow down and so decrease intersection crashes caused by speed. Traffic circles are not suitable for heavily-traveled routes, since they are at best a compromise with the street intersection.

Numerous factors, such as cost and design, must be considered before constructing a traffic circle. Since they require considerable land and more pavement, they are much more costly than the usual type of intersection. Furthermore, where there are many pedestrian crossings, vehicular traffic must be interrupted, and this decreases the desired steady flow. Like

any other traffic aid, traffic circles must be properly designed and appropriately used.

Grade Separations

Where two very busy major arteries cross, or where a very busy artery crosses a lesser road, a special type of intersection is needed to eliminate hazards and assure uninterrupted traffic flow. Several ingenious designs are used.



Courtesy U. S. Public Roads Administration.

FIG. 251. At this "diamond" intersection, all left turns are made on the minor cross street, none on the expressway. One such left turn is marked. The drainage canal in the foreground made it necessary to modify the typical diamond shape somewhat.

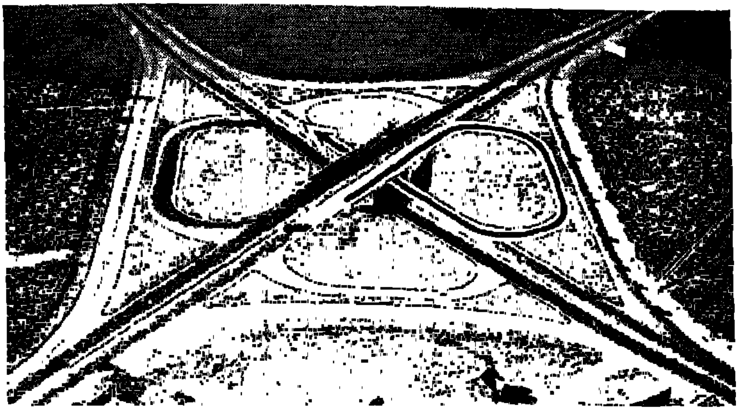
Straight-ahead traffic is kept moving at intersections by lifting one road over the other, just as a grade separation lifts a railroad over a highway.

Where a main artery crosses a lesser road, and where cross traffic and left turns are not very heavy, a *diamond grade separation*, such as is shown in Fig. 251, can be used to advantage. In this design, the connecting roads or ramps roughly form a diamond. Generally it is not a perfect diamond because such obstacles as streams or hills may force the designer to modify the shape. Left turns are made on the cross road just as at an ordinary intersection. Left-turn conflicts and hazards still remain, but they are removed from the main express artery.

Non-conflicting turns are made possible in all directions by

the *cloverleaf intersection* shown in Fig. 252. The standard method of making a left turn at a cloverleaf is to go straight past the cross street and then make a right-turn loop.

For heavy turning traffic, and at intersections of greatest importance, a *directional interchange*, such as is shown in Fig. 253, is generally favored. At directional interchanges, the driver changes from one route to another merely by turning to the proper interlacing lane or ramp. This design requires



Courtesy U. S. Public Roads Administration.

FIG. 252. Note the arrow on this cloverleaf showing how a left turn is made by turns to the right. This type of intersection eliminates the conflict caused by left turns and cross traffic.

one-way roads, not too close together, which may be thought of as ribbons arranged and interlaced to provide for interchange needs. This type of grade separation is more costly than the other because of the numerous bridges and the amount of land needed.

ENGINEERING THE HIGHWAY

Highway construction is costly. Road location and design, selected after a careful study by engineers, must be laid out on drawings for road builders to follow. Large sums must then be spent for a good foundation, a well-constructed, paved surface, drainage structures, shoulders, guard rails, highway sidewalks where needed, and roadside grading and planting to avoid

erosion and to make the highway and roadside more attractive.

A mile of new, concrete-surfaced highway, two lanes wide, can easily cost $50,000 in open country. Purchase of land for the road may vary in cost from a relatively moderate amount in undeveloped rural areas to hundreds of thousands of dollars per mile in built-up, urban areas. Construction of city streets involves additional expenses for curbs, sewers, and sidewalks,

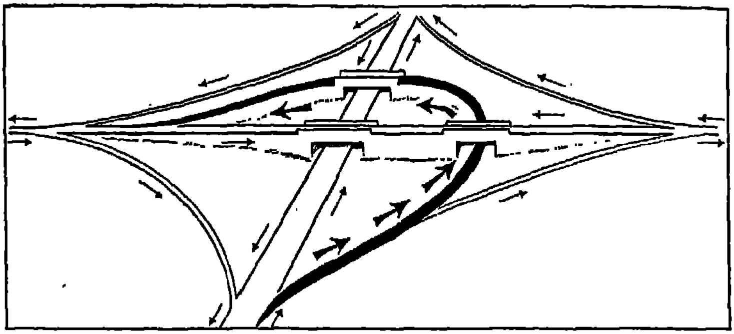


FIG. 258. The heavy arrows illustrate how a motorist makes a left turn, utilizing a directional left-turn lane of a new-type highway intersection known as a "directional interchange." Various ingenious designs for complete interchanges might have several such lanes.

and to make proper provisions for water and gas pipes, lighting cables, and other utilities under the surface. After a highway is completed, it must be well maintained to protect the investment and to avoid such hazards as bad shoulders, worn or broken surfaces, and eroding side banks.

Even before the highway engineer sends out his surveyors to plan a new highway, he must have many FACTS and make many major decisions. How important is the road going to be? How much traffic will it carry? How much bus and heavy truck traffic will there be? How many lanes wide should it be? For what speed should the road be designed? What type of pavement is needed? Is a divided highway warranted? For what minimum sight distance should it be designed? How much money should be spent for the road? How much will it cost to maintain it?

Problems like these show why there is a special science of highway engineering. Highway engineers must be highly trained and experienced to direct such work. They must always think in terms of developing a *suitable highway system* for existing and future needs and with available funds. The public loses money when it fails to insist that highway construction be done only under the supervision of experts.

Groups interested in highway development, such as highway departments, the United States Public Roads Administration, the Highway Research Board, and universities, make many valuable studies of traffic needs, and help build up a body of FACTS for the use of the highway engineer. Facts are needed on soils, foundations, pavements, drainage, construction and maintenance methods, economic justification of expenditures, and other road problems.

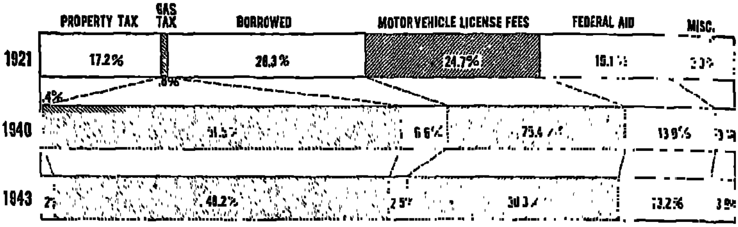
State Highway Planning Surveys, with the cooperation of the United States Public Roads Administration, provide facts for use in all highway work. Such surveys furnish the basis, for example, for better classification of highways. Highway classifications are important in helping decide what kinds of roads are warranted, what governmental agency should be responsible for various roads, and how much money should be spent on them. During the war, state and federal highway officials developed a new type of origin-destination traffic survey for urban areas. It is based on interviewing a selected number of home owners throughout the city to determine where and how they traveled on a given day. By expanding this information, engineers can choose the proper route location for street and highway improvements to serve the largest number of people, and can predict how much traffic each section of the new route will carry.

ROAD ADMINISTRATION AND TAXATION

While the states have the main responsibility for the primary highway system, the Federal Government, since 1916, has given considerable financial aid for important highways. For a state to receive such Federal Aid, it must have its Federal Aid high-

way plans approved by the U. S. Public Roads Administration, and the state must agree to maintain well all such roads.

Where else do states secure funds for highway purposes? Early roads were local in nature—locally administered and paid for principally by property owners. But as motor traffic



Based on Statistics from U. S. Public Roads Administration.

FIG. 254. Where does the money come from for road construction? Note how sources have changed in 22 years.

became less local, ***states began to tax the highway user*** for an increasing proportion of the cost of main highways.

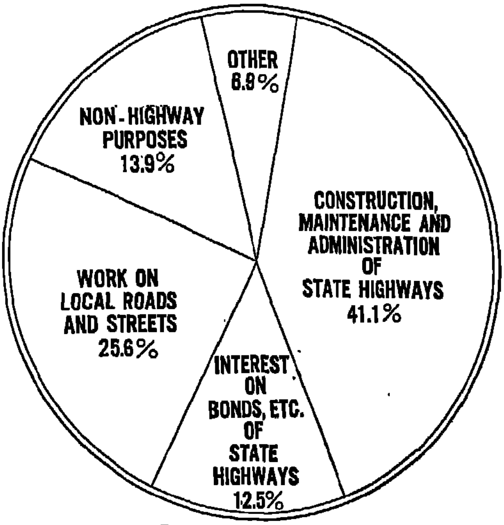
The gasoline tax, started by Oregon in 1919, proved a popular means of procuring the motorists' share of road cost. As a matter of fact, the users themselves suggested this tax in order to get better roads—one of the unique origins of taxation in our history.

Today, receipts from vehicle registration tags, driving license fees, and gasoline sales are used principally to build roads and maintain them. But other road beneficiaries, such as land holders, owners of businesses, and the general public, should continue to pay their fair share of construction and maintenance costs.

States are taking more responsibility for secondary highways. They are also assisting municipalities in paying for construction and improvement costs of main arteries which are "links" in the main highway system. Recent federal legislation made part of Federal Aid funds available, through the states, to increase greatly the funds for "farm to market" roads and for main city streets.

Highway planning surveys have shown that delay and congestion are mainly concentrated in metropolitan areas because

of the extremely heavy traffic. Indeed half of all road traffic is in urban areas and their suburban fringes. This means that much more of the motorist tax dollar must be used for main arteries in metropolitan areas. Most city streets, however,



Based on Statistics from U. S. Public Roads Administration

Fig. 255. How the motorist's special tax dollar is spent.

come under the jurisdiction of the city and are paid for mainly out of general taxes.

The less important a highway is, the less should be the proportionate share paid by special motorist taxes, and the more should be the percentage paid by others who benefit.

Some of the special taxes which motorists pay have been used by some states for non-highway purposes. This practice is unfair and should be stopped, for such revenue is badly needed for highway improvements.

During the war, the money, materials, and labor needed for a normal rate of road construction, modernization, and repair were not available. They had to be almost entirely diverted for war purposes. Consequently, at the end of the war thousands

of miles of roadway were badly in need of construction or improvement.

We need adequate metropolitan arteries, removal of highway hazards, more divided highways, and more grade separations. Considering the tremendous job ahead in providing highways fitted to modern needs, it is clear that *all special motorist taxes should be used exclusively for road purposes.*

A LOOK TO THE FUTURE

The highway engineer faces many serious problems. He must combat the efforts of certain self-seeking politicians and groups with special interests to have money spent where studies show that the expenditure is not warranted. He needs the *support of an informed public* to help him fight such efforts and to help him find ways through research of making the highway dollar do more in providing for highway needs.

The rapid change in highway needs is a serious problem.

A few years ago no one could have foretold how rapidly motor traffic was going to grow or how speeds were destined to increase. These changes have made unexpected demands on our highways and since well-built roads last for decades, many have now become out of date and no longer suited to traffic needs.

Try then, to picture additional millions of cars on our highways within the next few decades!

We seem to need an organized, national body of authorities and leaders among highway, automobile, and traffic engineers who can pool their information and ideas and decide together what future highways should be like, so that roads will be much more likely to be effective and safe as long as they last.

The future will see marked changes, especially in design of main highways. It is already generally agreed by experts that all cross roads should be carried over or under our most important heavy traffic highways. The idea of having a central separator strip for all highways that are four lanes or more in width has been adopted as a standard.

Expressways

A further development of these ideas which will be more and more used in the future is the expressway or, as it is known in some places, the "controlled-access highway." The distinguishing feature of such a highway is that it provides express movement without interruption from cross traffic, or from entering vehicles. Entrance and exit can be made only at locations selected and designed by the highway authorities. In urban and suburban areas, access points usually known as "interchanges," involve grade separations and other special design features.

Control of access—entry to or exit from the express lanes—is accomplished by public ownership of an "insulating strip" of land on each side of the highway. No entrance or exit roads are permitted across this publicly owned strip except at selected points, the locations and designs of which are determined by the highway authorities. Cross traffic goes over or under the express lanes.

These design features eliminate the hazards of the familiar highway caused by farm wagons coming onto the road unexpectedly, or by vehicles turning into or out of fast traffic lanes anywhere and everywhere because of such things as restaurants, garages, filling stations, refreshment stands and private driveways. Private properties adjoining the publicly owned insulating strip and needing outlets are provided with service roads which lead to interchanges.

In addition to a central dividing or separator strip, high-type expressways have wide lanes, long sight distances, easy curves and grades, and high-quality paving. The Pennsylvania Turnpike, opened to traffic in 1940, is in most respects an example of what a modern expressway should be like.

We often hear of a "freeway" and a "parkway." Both are expressways, the difference between them being that all vehicles are permitted to use a freeway while a parkway is not open to commercial vehicles.

The parkway, so named because it is in effect a special purpose road in a park or park strip, has been extensively used

in and around New York City, in Connecticut, and in certain park-like areas such as those along the Blue Ridge Parkway in Virginia and North Carolina.

Modern expressways, both of the freeway and parkway type, should produce very low accident rates. The Merritt Parkway, for example, in its first four years of operation had a rate of 4.3 traffic deaths per 100 million vehicle-miles of travel, which was only one-third as high as the rate of the nation as a whole. A study of a Los Angeles expressway showed it to have only one-quarter as many accidents as Los Angeles streets with similar traffic volumes. Chicago's Outer Drive which has many expressway characteristics had only eight accidents per 100 million vehicle-miles of travel, compared with 189 on ordinary streets in the same area.

But modern highways of this type are very expensive. So we can expect them to be built only where traffic is very heavy.

National Defense

National defense needs justify certain highway improvements. These include a special priority system of highways of military importance, and expressways and other special highway developments in and through metropolitan areas, and between key areas where traffic is very heavy. One or more highways linking the countries of the Western Hemisphere will not only bind together the peoples of the Americas but will be of great value in economic development.

Research

Our country has led the world in road research, and such work has saved millions of dollars and countless lives.

We are entering a new postwar era in the development of our highway system. No longer can just any old road be improved and used. Main roads will have to have a good safety factor for increased speeds and heavier traffic loads. We need more accurate knowledge about how they should be built.

Such groups as the United States Public Roads Administration, the Highway Research Board, the states, and other in-

terested organizations will continue valuable research in a wide variety of highway problems.

We need constant road research. And we need more well-trained engineers with not only improved technical knowledge, but with *a broad vision for the needs of the future.*

DISCUSSION TOPICS

1. Why are many miles of rural road unsuited to today's traffic needs? Select some road your group knows and discuss what ought to be done to modernize it.
2. Discuss the statement: "We can't afford to correct road hazards. Instead, drivers should suit their driving to road conditions."
3. Debate: Special motorist taxes should be used only for warranted road purposes.
4. Discuss the interest shown by the Federal Government in the development of our highway system. What are the main points which justify Federal Aid for highways?
5. Discuss the part played by toll roads in the early development of our highways. Why have toll roads been practically abandoned? How are tolls for the Pennsylvania Turnpike justified? Can toll bridges be justified? How?
6. At the present time, what appear to be the most urgent needs for the roads of the immediate future?

PROJECTS

1. Collect pictures of traffic circles, cloverleafs, and "directional turn" grade separation intersections. Make diagrams of these intersections and illustrate to your group the route to be followed in making every possible kind of turn.
2. On a map of your county, indicate with blue pencil the paved roads of ten years ago. With an orange pencil, show roads which have since been paved. With a red pencil, show roads which have been *materially* improved. Discuss the map with your group, pointing out any roads which *now* deserve special attention.
3. Inquire as to the cost of construction for various improved highways in your vicinity. Calculate the cost per mile and per foot. Make a chart showing name of highway, length of highway, type of construction, average cost per mile, average cost per foot. Discuss this chart with your group.
4. Using Fig. 255 as a pattern, make a similar "tax dollar" distribution chart for your state. Discuss the differences you discover.
5. Find out how a concrete highway is constructed. How important is a firm foundation? About how thick is the concrete layer?

Where is it thicker, at the center or at the edges? Why? Are steel reinforcing rods ever used? Construct a model or make a large drawing showing the various steps in the construction of a concrete highway. You can pattern your model after the one illustrated in Fig. 246.

6. Find out what has been done in your state with the Highway Planning Survey. In a report to your group, describe its values.
7. Find, if you can, a road in your vicinity that originated as an Indian trail, pioneer pathway, or early connecting link between important points. Investigate the history of this road. Write out its "life-story" or write a script for a radio dramatization of its development.
8. Find out what factors were responsible for the creation of the highway department in your state. Describe this development.

FOR FURTHER READING

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CHAPTER XXII

Managing Modern Traffic

Do You Know:

How traffic engineers improve traffic situations?
What traffic engineers need to know?
What the future of traffic engineering is likely to be?

TRAFFIC ENGINEERING FOR THE MOTOR AGE

WHEN sound traffic engineering is applied to traffic problems, guesswork is out. Improvements are made only after FACTS are gathered to point the way.

Good traffic engineering results in orderly and efficient traffic flow, with increased safety and convenience for all street and highway users.

Parking in the central district of a large city was causing serious delays and congestion. What should be done? "Prohibit all daytime parking in the whole district," someone suggested. "That's what Chicago did in its Loop district, and it worked wonders."

The suggestion seemed like a good idea, and the City Council passed an ordinance eliminating daytime parking in an area of nearly two square miles.

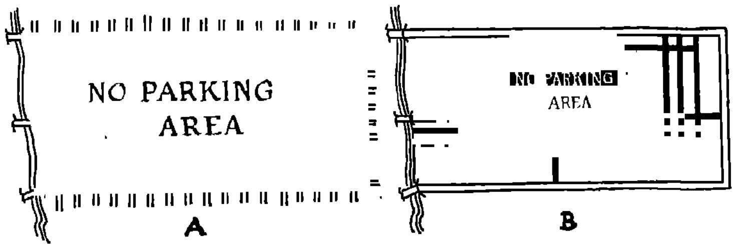


FIG. 256. Traffic engineering studies showed that a large no parking area was unnecessary. (A) Unnecessary restrictions made before engineering study. (B) Suitable restrictions made after study.

But in this situation the regulation did not work. Before long folks were violating it. The police could see that such a wide no-parking restriction was unnecessary and they were "short-handed" for officers to enforce it. So they tagged cars

on some streets but not on others. Confusion and complaints resulted.

Here was an example of regulation based on nothing but imitation and guesswork. No careful study of the local situation had been made.

The city then employed a traffic engineer. One of his first jobs was to straighten out the downtown parking situation. First he gathered FACTS. He considered street widths, volume of traffic, speeds of cars on various streets during both easy and "peak" hours, the demand for parking, the need for loading commercial vehicles, the number of street cars and buses using various streets, and many other facts that an engineer must have. He then recommended restrictions on parking in a very much smaller area and on certain major streets. See (B) in Fig. 256. The result was the removal of confusion and discrimination and a sane, logical solution of a bad traffic condition.

Traffic engineering can no longer be considered as merely the hanging of signs and signals and the marking of streets.

The traffic engineer works out ways of getting the safest and most efficient use of existing streets, highways, and parking and loading facilities. He applies his knowledge of the way drivers and pedestrians act. He determines how much traffic a certain street or intersection can carry in peak hours. He adapts traffic to streets to minimize delays and congestion.

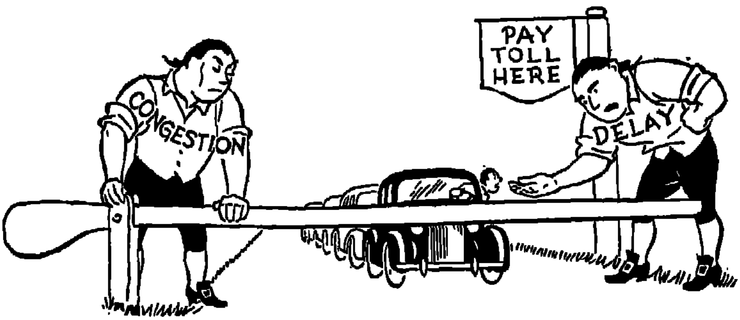


FIG. 257. Methods must be found to eliminate the tollgates of *Delay* and *Congestion*.

He surveys the origins and destinations of vehicles and plots their most favorable routes. He spends much effort on the prevention of accidents. He gives valuable aid in the redesign of intersections and highways that are not fitted to modern traffic needs. He also helps plan the highways of the future.

Railroads and local transit companies never try to operate *their* transportation systems without engineers to work out routings, schedules, stopping points, accident prevention measures, and many other problems. Why then, should cities and states not provide traffic engineers to help plan the operation of the vast transportation systems represented by their streets and highways?

The only sensible way to tackle traffic problems is to *get the facts,* study them carefully, and then devise and use the remedies needed.

THE CITY TRAFFIC ENGINEER AT WORK

In a large part of his work, the traffic engineer leans heavily on accident records. Let's see how he uses them.

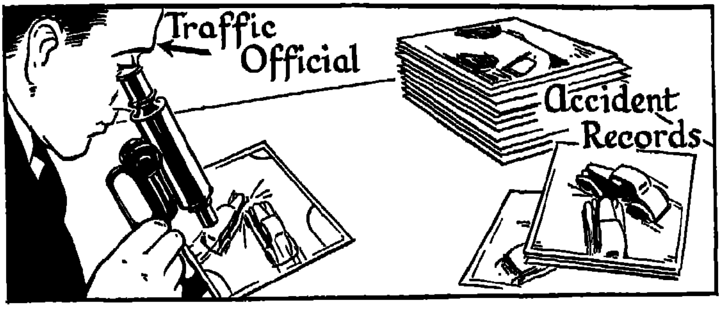


FIG. 258. Detailed traffic accident records often give clues to troubles which can be corrected.

Accident Prevention

One job of the engineer is the correction of conditions that cause repeated accidents at certain locations.

Obviously, he must first find out *where* the worst accident locations are. Accident *spot maps* help him do this. Clusters

of spots indicate places where the accident toll is especially heavy. Accident records also help. They are filed by the location of each crash, and after a time a *worst corner* list is prepared.

After each "worst corner" has been located, the next question is: "*Why* does this particular intersection have so many crashes?" The traffic engineer must now search for clues to the answer. He makes a "collision diagram" showing the directions of vehicle movements and pedestrians involved in the accidents, the time of day or night, the time of year, and other helpful facts. (See Fig. 259.) He analyzes all the *facts* and studies the location in the field, always looking for clues to the trouble.

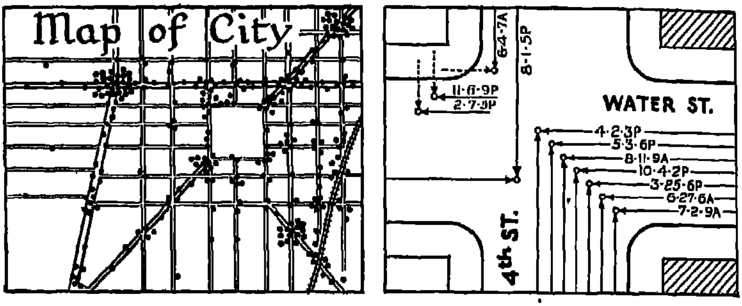


FIG. 259. Making good use of traffic accident records. The "worst corners" are located by means of an accident "spot" map (left). Collision diagrams (right) offer one means of analyzing these intersection accidents. This diagram shows north- and west-bound vehicles involved in most of the accidents. Traffic engineers find remedies through such "clues."

Usually the traffic engineer can spot the trouble at "worst corners" and put remedies into effect. The remedy may be removal of a sight obstruction at a corner, such as a high hedge, shrubbery, or a billboard. Or it may be necessary to install one or more stop signs, or islands to aid pedestrians and cause vehicles to move in a more orderly way. In other places, a stop-and-go signal may be needed. The best remedy is the one which will correct the situation with the least interference to traffic movement and still will not be too costly.

The traffic engineer uses accident facts in many other ways. He helps the police official in charge of traffic use his men where they can do the most good in preventing accidents. He recommends needed regulations. He prepares material for traffic

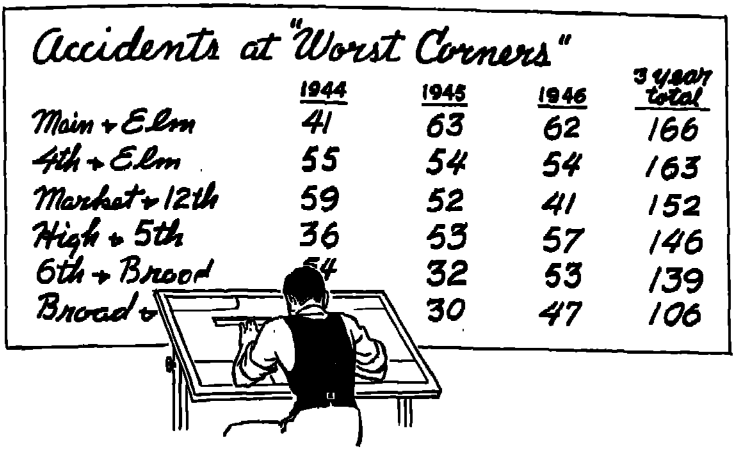


FIG. 260. WHY do these locations have so many accidents?

education. People who are careful to give complete and accurate reports when they are involved in traffic accidents help traffic engineers in their accident prevention work.

Traffic Signs and Signals

The traffic engineer determines the need for traffic signs and signals. He decides what types should be used and how they should be controlled, and then installs them.

In the past, signs often caused confusion because they were not standardized and because they were set up in the wrong places. States and cities need traffic engineers to make sure that standard signs are used, that the most important ones can be seen at night, and that they are placed only where *facts* show they are really needed.

Traffic control signals can help to remedy conditions at certain intersections, or they can be a source of needless delay

and irritation. If they are installed haphazardly, they cannot be expected to reduce accidents or eliminate congestion.

Three separate studies have shown that signals installed at intersections without a proper analysis of facts actually produced an *increase* in accidents in about 30 per cent of the cases and *no change* in about 15 per cent.

Traffic engineers use definite measurements in deciding whether or not traffic signals are needed at an intersection. If signals are needed, they are installed in standard positions, with red, yellow, and green lights of standard meanings, appearing in a standard order.

The method by which the signal is actuated, or controlled, should also be decided by the engineer. Some signals are electrically controlled and change automatically at intervals predetermined after studies have been made of traffic needs at the location. In certain places the signals are manually controlled, either by the officer on duty or by pedestrians. Still another example of efficient traffic handling is the use of signals controlled by the passage of a vehicle over a switch in the pavement. This is known as a "traffic-actuated" signal.

Signals installed by someone who is not continuously studying traffic requirements are often badly located. If they are too high, hidden by branches, or in a non-standard location, they can actually be "crash-breeders." A competent traffic engineer avoids such misplacing.

Proper traffic signal engineering is a great benefit to drivers. Have you ever driven along an "artery" with many signals on it, and been stopped by many red lights? On the other hand, have you driven in a "flexible progressive" signal system and been pleased at the way each signal changed to green as you approached, provided you drove at the speed for which the system was timed? See Fig. 221. What makes the difference? In the first case, no study had been made of how to get the best movement along the artery. In the latter case, traffic engineering had been applied.

Pedestrian Signals

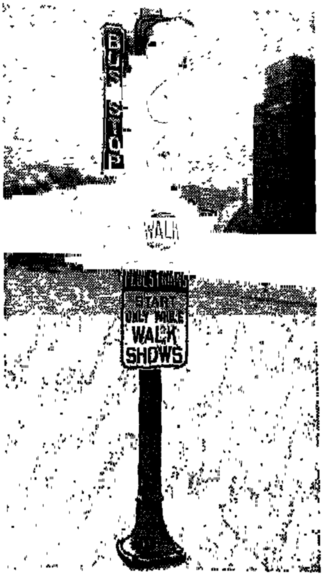


FIG. 261. One type of pedestrian signal.

Traffic control signals are adapted by the traffic engineer to fit the needs and convenience of pedestrians as well as drivers. Signal faces are placed directly in the pedestrian's line of vision, and both the order and timing of the signal cycle are designed to include his needs.

The shorter the signal cycle, the more likely the pedestrian will obey the signals. If the cycle is too long and a stream of motor traffic is not using the intersection, the pedestrian grows impatient and is tempted to cross against the signal. The cycle should be just long enough to clear waiting cars and closely bunched, moving lines of vehicles. Where traffic varies greatly at different times of day, a shorter cycle should be used in non-peak hours.

In some cities, traffic engineers provide WAIT and WALK signals for pedestrians at busy intersections. In some places, the WALK signal shows during only the earlier part of the green GO signal, so that pedestrians will not start to cross too late and be caught in the street when the light changes. At certain other especially busy pedestrian crossings, the WALK signal may show when all vehicular signals are red. Such an "exclusive pedestrian interval" assures the pedestrian an opportunty to cross without being interrupted by turning vehicles. But because it decreases the time available for vehicles to move, the exclusive pedestrian interval is used only where careful study indicates that it is warranted.

In certain locations, such as school areas, factory sites, and

sports centers, where pedestrian traffic is heavy only at certain times, the traffic engineer solves the problem with pedestrian WALK signals that can be "demanded" or actuated by a push button. The pedestrian pushes the button located on a post at the curb. The signal soon changes in the pedestrian's favor. After a reasonable interval, during which the pedestrian can cross the street, the signal automatically changes back to permit motor traffic to proceed.

Routing Traffic

Did you ever travel in a city that seemed to have stop signs everywhere? Often the trouble in such cities is that some untrained person assumed that the way to help traffic move and to reduce accidents was to create many "through streets" with stop signs at all "cross streets."

Studies in San Francisco, in New Jersey, and other places proved that haphazard "through street" systems actually *increased* accidents! One reason for this is that drivers decide there is no need for so many stops and unwisely take the matter into their own hands and violate the stop signs.

A sound "through street" plan requires careful study. One kind of study is illustrated by a *vehicular flow map* like that

Courtesy Bureau of Traffic Planning, Pittsburgh, Pennsylvania.

Fig. 202. This vehicular "flow map" shows which streets carry heavy traffic.

in Fig. 262. It shows which streets are carrying the most vehicles. The width of each black band tells how many vehicles use the street.

In planning a sound "through street" system, the engineer must know what streets normally have heavy traffic. He must also consider street widths, road surface conditions, relative freedom from "cross traffic," advisable speeds, directness of route, and methods of avoiding congested sections like neighborhood business centers. Here is another job that can be adequately handled only by a trained traffic engineer.

The routing and "by-passing" of long-distance, through traffic must be considered in planning a "through street" system. Out-of-town drivers, who merely want to get through a city quickly and conveniently, appreciate good "through street" planning. However, undue emphasis should not be placed on by-passing larger cities, for numerous studies show that most traffic approaching all but quite small cities has its destination *in the city.*

Good Engineering at Intersections

Traffic engineering data and experience are valuable in the design of intersections. The type best suited to the needs of a particular location, whether traffic circle, cloverleaf or other type of grade separation, can be selected only after an engineering study.

Have you ever entered an unfamiliar, irregularly-shaped intersection with so much roadway area that you were puzzled about which path to follow?

Intersections designed without adequate study of how they are to be used frequently cause confusion, delay and accidents. The traffic engineer can often help avoid and correct such bad intersection design.

Note, in Figure 263, that left turns cannot be made except around *islands* which induce drivers to follow the proper pathways, and that special provision is made for certain right turns. The traffic engineer so locates such islands that the correct way is the natural and safe way to turn. Turning vehicles move in *channels* planned to reduce the number of points

where they can come into dangerous conflict with other vehicles and pedestrians.

Usually a raised island is much better than a painted line. This is especially well illustrated in Figure 264.

Courtesy Milwaukee Safety Commission.

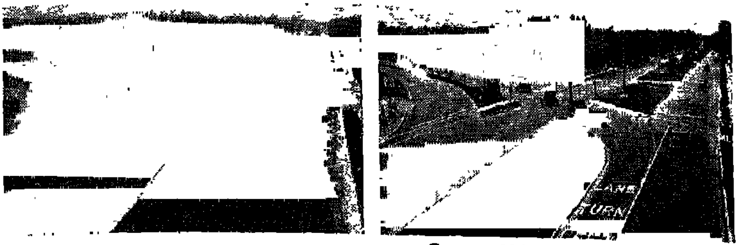
FIG. 263. "Islands" aid both pedestrians and motorists at this intersection.

Properly placed intersection islands also greatly aid pedestrians.

Loading Islands and Safety Zones

Loading islands, properly designed by the traffic engineer, give the pedestrian protection while entering, leaving, or waiting for a bus or streetcar.

Various types of islands are used. Sometimes the island, or *safety zone*, is simply outlined with steel posts and chains. Raised loading islands are constructed of concrete, wood, or steel and are designed for maximum protection of the pedestrian. Their length is determined by the number of streetcars or buses which must load and unload at the same time. They are usually about 4 feet wide, 5 to 7 inches high; often they have barriers to separate the platform from the vehicle



Courtesy Milwaukee Safety Commission.

Fig. 264. Compare the hazards to pedestrians and motorists before and after "islands" were constructed.

lanes and to force the pedestrian to enter and leave the island at the crosswalk end. This type of loading island protects the pedestrian, keeps the traffic pattern orderly, permits the driver to proceed without interruption, and reduces loading and unloading time for streetcars and buses using them.

Crosswalks

To encourage the pedestrian to cross only at intersections, the traffic engineer sees to it that pedestrian crosswalks are provided and maintained. The markings are generally made either by paint or by buttons or other pavement inserts. Crosswalks are generally about as wide as the sidewalks of which they are extensions. At heavy pedestrian crossings they may be somewhat wider.

Mid-block crosswalks are sometimes provided at special locations determined after thorough study by the traffic engineer. Such crosswalks must be marked especially clearly and well illuminated so that they will be easily recognized as pedestrian crosswalks by the driver, who does not ordinarily expect a mid-block crosswalk. To aid the driver in such special circumstances, the crosswalk lines should be 24 to 30 inches wide.

To assure the use of crosswalks and prevent "jay walking," barriers of chain, pipe or rope are sometimes erected on the curb adjacent to crosswalks, or at especially dangerous places.

Pedestrian Tunnels and Overpasses

Heavy pedestrian traffic frequently conflicts seriously with heavy vehicular traffic at or near sports areas, schools, factories, beaches, parks, and business centers. At such points, traffic engineers sometimes propose either pedestrian tunnels or pedestrian overpasses. This completely removes the danger of pedestrian accidents if pedestrians cooperate fully by using the tunnel or overpass. But, unless forced to use them by well-designed barriers or by police or school authorities, some pedestrians unfortunately prefer the hazard of a surface crossing to the inconvenience of climbing up or down. Tunnels and overpasses built with ramps rather than stairs are more popular with pedestrians and bicyclists, for the ramp type of approach seems much easier than the stairway.

In the city of Los Angeles, over 100 pedestrian tunnels have been constructed, chiefly near schools. Chicago has provided overpasses at key points across parkway drives. While such structures are costly, the expenditure is more than justified, where needed, by the saving of lives, the prevention of pedestrian injury, and the elimination of vehicle delays.

Safeguarding Residential Areas

Most of our older residential districts were laid out in rectangular, "checkerboard" fashion and are ill-fitted to modern traffic needs.

Traffic becomes too heavy for one artery and some of it moves over to what was a quiet residential street. The motorist sees a smooth, wide street which will take him straight toward his destination and decides to use it to avoid heavy traffic. Soon other drivers find this less used route. It becomes another busy, noisy, secondary artery.

From the point of view of residence owners, the street is ruined. Hazards to both drivers and pedestrians are increased. Mothers dare not send children to playgrounds because of the busy streets they must cross en route. Residents quickly get tired of the noise, fumes, dirt, and heavy traffic. They decide to sell their homes, take a loss, and move to a quieter, more

pleasant location. A few corner stores and gasoline filling stations appear, attracted by the heavier traffic. The value of residential properties drops.

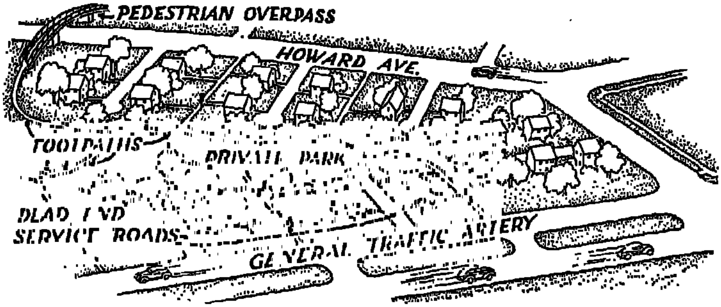


FIG. 265. A residential area planned to avoid the usual traffic hazards and annoyances.

The old checkerboard layout of residential districts was all right for horse-and-buggy days. But *something quite different is needed for the motor age.*

Fig. 265 shows part of the plan of Radburn, New Jersey, a residential community designed for the Motor Age. Note the wide general-traffic artery with the central separator strip. Secondary arteries like Howard Avenue serve traffic which wishes to pass *through* the district. Narrow, dead-end roadways with small "turn-around" circles at the ends serve the backs of the residences. The butcher, the baker, and the electrician use these service roadways, and family garages are entered from them.

See what this community engineering means to the residential area. The houses front on a private park area with footpaths conveniently located. No vehicular traffic roars by, because the little roadways do not connect. Children can go to school or playgrounds without ever crossing a vehicular roadway, for the plan includes underpasses and overpasses.

Progressive traffic engineers, eager to save lives and conserve residence property values, are cooperating with city planners in trying to induce large owners of real estate to adopt such

moden planning ideas. Citizens of the future will want to live in such a district.

Play Places

No town or city can be proud of children playing in its streets. With today's traffic conditions, street play is extremely dangerous. The majority of child pedestrian deaths and injuries occur to children playing in streets or crossing streets while at play. The obvious remedy is to provide play places to *keep children off the streets.*

Children under six need play yards in their own block. Older children need larger play areas, such as playgrounds and parks.

Courtesy City Housing Corp., New York.

FIG. 266. Pedestrian underpass—Radburn, New Jersey.

Progressive traffic engineers encourage community playgounds, with sandboxes, teeters, swings, or other proper equipment for the children who will use them. They use accident facts and other data to determine where playgrounds are most needed. They propose play areas where they can be reached with a minimum of danger, and design barriers in front of exits to prevent children from running carelessly from playgrounds into the streets.

Where play places are not otherwise available, the traffic engineer may recommend "play streets," blocked off during

play hours to all traffic except that to destinations within the block.

New York is a good example of a city which has shown progressiveness in playground engineering. It has planned many attractive, well-equipped play spaces and supplied well-trained, experienced supervisors under whose guidance children like to play.

Street Lighting

Traffic engineers are needed for designing proper street lighting. Street lighting has been proved by numerous studies to have a close relationship to night traffic accidents.

Officials in one of our largest cities blame poor street lighting for a major part of its pedestrian death toll.

Standards for effective traffic lighting are now available. There are practical methods of scientifically determining how efficient the lighting is on any street and how nearly it approaches correct standards. Greatly improved street lighting units are also available. When properly spaced and mounted high, they give a uniformity of illumination and a lighting efficiency not possible a few years ago.

Few city streets are now found to measure up to satisfactory standards of lighting. They need modern lighting, properly installed under the supervision of trained engineers.

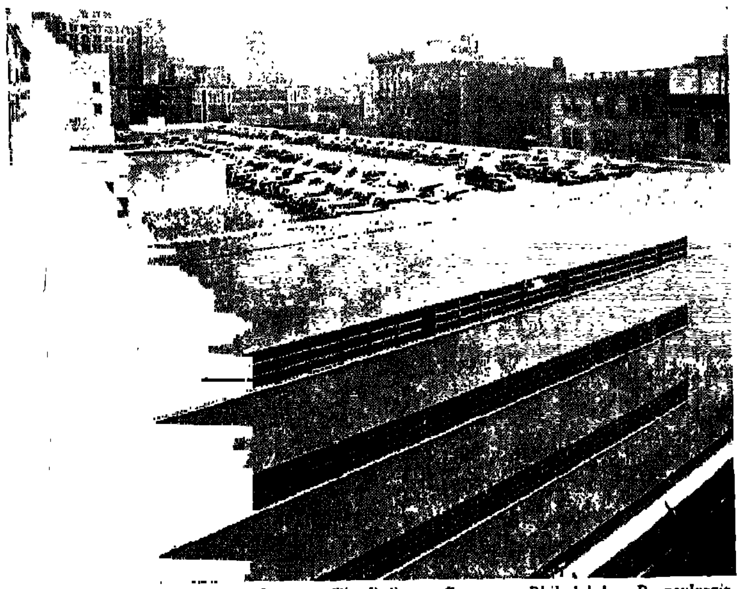
Where Shall We Park?

Where to park is a major question in the business district of most communities today. With vehicular traffic growing heavier and heavier, the amount of street space available for parking becomes smaller and smaller. More street space is needed for loading and unloading and for the movement of vehicles. Even where curb parking can still be permitted, the parking time is limited to enable more drivers to use the space.

The trend is to provide for storage of vehicles *off the streets.* One such multi-level storage structure is shown in Fig. 267. Some buildings now provide car storage space on several floors, often below the street level. And, in most cities, parking lots abound.

The city traffic engineer studies parking needs and helps develop sound plans for off-street facilities. He makes recommendations for location, size, and type of parking areas. He carefully studies the location of entrances and exits, for if they are poorly located they cause serious congestion. Property owners who want to install off-street parking businesses can make valuable use of such engineering studies.

Cities need to develop comprehensive downtown parking plans and programs. The traffic engineer, working in cooperation with the city planning agency, the city engineer, and property owners, can provide the many facts and forecasts needed.



Courtesy The Ballinger Company, Philadelphia, Pennsylvania.

FIG. 267. What a relief to find this kind of off-street parking place!

City Parking Authorities or Boards should be set up to decide matters of policy. They should review proposed plans and programs, decide which to adopt, determine the financing methods to be used, and then be responsible for putting adopted plans and programs into effect.

Lack of adequate parking facilities can cause decreasing property values in downtown districts. This results in losses to the city of badly needed tax revenues. City parking presents a situation too serious to be allowed to drift.

TRAFFIC ENGINEERING IN RURAL AREAS

Traffic engineers are as much needed in rural areas as in cities. Their responsibilities include collection of factual information, erection of warning and guide signs, installation of traffic signals, pavement marking and provision of advice on highway design problems.

A good example is the safeguarding of pedestrians by the construction of highway sidewalks. Such walkways are mainly needed in the outer sections of cities and towns, near schools located at the edges of towns, and near communities where

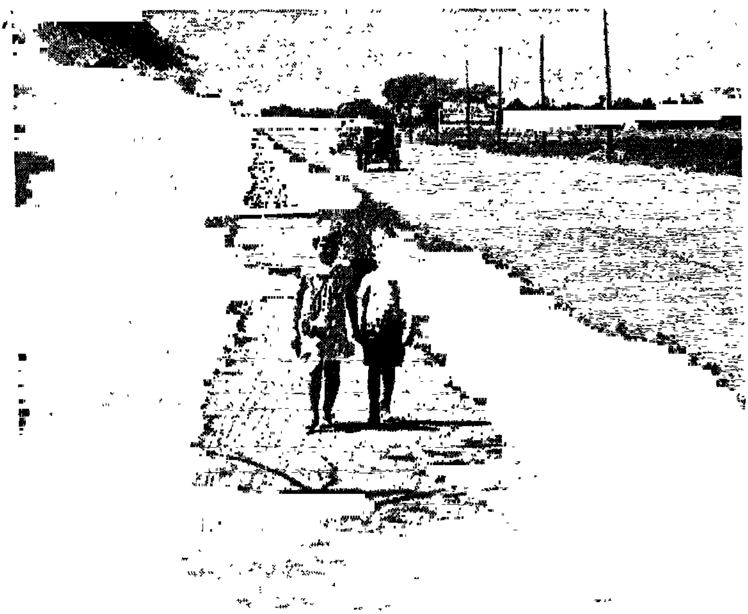


FIG. 268. Sidewalks along rural highways are valuable in preventing pedestrian deaths and injuries.

pedestrian traffic is moderately heavy. Highway sidewalks must have hard, smooth surfaces, must be carried across side roads which become muddy or rutted in bad weather, and must be kept cleared of snow, mud, leaves, or debris at all times.

In 1944, about 3,500 pedestrians were killed and more than 12,000 injured on rural roadways. Well-engineered pedestrian sidewalks are obviously needed along much-used sections of rural roads. Yet only a very small mileage of highway sidewalks exists today.

The State of Massachusetts constructed 500 miles of walks along chief traffic arteries, and, in six months, the pedestrian fatalities in these areas dropped 31 per cent. This is another example of the effectiveness of good engineering.

Rural no-passing zones need to be clearly worked out and marked. Speed zoning should be scientifically determined and speed signs that can be clearly seen both day and night should be erected. Rural danger points should be hunted out and remedied. Important rural intersections need to be redesigned or protected on the basis of traffic engineering studies. Rural accidents can be reduced through traffic engineering analysis. Such rural improvements are problems for the engineer.

GROWTH OF TRAFFIC ENGINEERING

The first municipal traffic engineers were employed by Pittsburgh, Pennsylvania, and Seattle, Washington, in 1924. A very slow growth in this new engineering specialty followed. Recently, however, growth has been more rapid, until today many larger cities and states have engineers devoting their full time to traffic matters. At the present time, some 30,000,000 people live in cities where traffic engineering is being carried on continuously.

Opportunities for men who are especially fitted for the profession of traffic engineering will increase. Every city of over 50,000 population needs full-time traffic engineering. Many counties and all states can be expected to employ such specialists.

The Federal Government already uses a goodly number. Safety organizations employ traffic engineers. Certain semi-private and private organizations, such as transit companies, insurance groups, automobile associations, and consulting engineering firms make the demand greater. As traffic volumes grow and speeds increase, there are more public needs and demands for accident reduction and less congestion and delay. The future will see traffic engineering increasingly emphasized.

Evidence of the growing realization of need for men trained in this work is to be found in the opportunities for special training. A number of universities now offer special courses dealing with traffic problems in their engineering schools. Yale University, through its Bureau of Highway Traffic, offers a one-year graduate course in traffic engineering.

The first university short course in traffic engineering was held in 1937. Since then, a number of short courses designed to provide specialized training for engineers already employed by municipalities, counties, and states, have been offered at colleges and universities. Young engineers are also getting special traffic training while working in the offices of experienced traffic engineers.

The value of traffic engineering has been proved in many localities. For instance, the installation of a signal system and the institution of parking regulations in the Chicago Loop district, after a thoroughgoing traffic survey, reduced accidents about one-fifth and speeded up vehicular traffic about 50 per cent. The establishment of marked traffic lanes on a major artery in Philadelphia increased the number of vehicles which could use the street in peak hours by about one-third. In another city, special markings on a major boulevard enabled each of 60,000 motorists to save six minutes daily. The first year's operation of the signal system on North Broad Street in Philadelphia reduced fatalities from twenty-three to eleven.

There is ample evidence that good results can be obtained from this factual approach to traffic problems.

DISCUSSION TOPICS

1. Does your city have traffic engineering service? Your state? If so, what evidences do you see in your community? Along your state highways?
2. Under what conditions is automatic traffic-signal control preferable to police officer control? Discuss the advantages and disadvantages of each type of control.
3. Discuss the various ways of so managing traffic at intersections that congestion and accidents are reduced.
4. Do you think that separate highways should be provided for trucks? Justify your opinion.
5. Discuss the advantages and disadvantages of "through streets."
6. What specific action should your community take to safeguard pedestrians? Discuss the situation in your state regarding sidewalks along rural highways.
7. What conditions, such as roadway widths, speed, traffic volumes, etc., should be considered in determining whether a pedestrian island is needed at a certain location?
8. Are the school children in your community properly protected when going to and from schools? When at play? Discuss the need of better protection and control at specific locations. How can faster progress be made?
9. Explain the close connection between sound pedestrian practices and adequate engineering facilities to protect pedestrians. Are your local engineering facilities such that sound pedestrian practices are encouraged?

PROJECTS

1. Find out what important traffic studies *your* community has made in the last few years. What were the main findings and recommendations? What has been done about them?
2. Make an accident spot map of your community representing each accident that occurred during the past six months or year. Indicate the type of accident by the size, shape, and color of the spot. Visit points where accidents are numerous and make suggestions for remedies.
3. Study intersections in your neighborhood where there have been numerous accidents or where brakes are always screeching. At which ones might the accident situation be improved by cutting down a hedge, trimming low branches of a tree, installing channelizing islands, or employing other means?
4. Make a diagram of the streets in some business area of your city. Indicate in red the no-parking zones along these streets. Indicate in blue the restricted parking zones. Show your diagram

to a traffic officer and ask for his comments on the parking problem in that area. Report.

5. Prepare a map of main highways near your community or entering it. Show how through traffic is, or may be, by-passed.
6. Make a survey of traffic signs and signals in your vicinity or along major highways in your community, and prepare a report on how well they are standardized.
7. What has your city, county, or state done towards providing highway sidewalks? Perhaps your group can take some action on this subject and direct it to the appropriate official.
8. Build a model or make drawings of an irregular street intersection in your community to show (1) the dangers presented to both motorist and pedestrian, and (2) the way in which these dangers are, or could be, lessened by installing islands.
9. Design and draw a plan for adapting some undeveloped area of your city to suit the Motor Age. Reduce pedestrian and vehicular conflict to a minimum. Plan for adequate playgrounds and traffic control devices.

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